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THE UNIVERSITY OF ALBERTA

GEOGRAPHY, ENERGY, AND ENVIRONMENTAL ATTITUDES: AN INVESTIGATION OF POLICY SCENARIOS AND PUBLIC PREFERENCES

by

© RICHARD GEORGE KUHN

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF GEOGRAPHY

EDMONTON, ALBERTA

SPRING 1988

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled GEOGRAPHY, ENERGY, AND ENVIRONMENTAL ATTITUDES: AN INVESTIGATION OF POLICY SCENARIOS AND PUBLIC PREFERENCES submitted by RICHARD GEORGE KUHN in partial fulfilment of the requirements for the degree of DOCTOR OF PHILOSOPHY.

Supervisor

External Examiner

Date October 23, 1987

Abstract

The study of society can be undertaken from two perspectives. One is concerned with the micro-processes that underlie individuals' perceptions of and behaviour in society and the environment. A second approach focuses on the study of society, of social institutions, and socio-cultural change on an aggregate level. Behavioural geographers have generally adopted the former research perspective. However, the merging of the two "scales" of investigation has become necessary in order to uncover the dynamic interrelationship between the individual and society in an empirical manner. This issue is addressed through an investigation of long term energy alternatives for Canada and Alberta as advanced in four energy development scenarios (forecasts and backcasts), and those favoured by a sample of the Alberta public. The concept of environmental paradigms is used to evaluate the energy scenarios and public committment to the world views. Areas of congruence and disagreement between the forecasting agencies and the public are then identified. A major assumption made is that the fundamental attitudes and values held within a society are major and crucial determinants of the choice of an energy strategy, and of resource use generally.

Based on the methodologies employed, the assumptions and objectives incorporated, and the emphasis given to various energy alternatives, it was found that two of the energy forecasts (Economic Council of Canada, Energy Resources Conservation Board) were more closely aligned to "Dominant Social Paradigm" (i.e. the *status quo*) than were two energy "backcasts" released by the Friends of the Earth and the Alberta Environmental Coalition. The latter two studies were representative of "New Environmental Paradigm".

Public committment to the alternative environmental world views was ascertained by means of a questionnaire survey sent to a random sample of households in Calgary and Edmonton. Relationships between world views and energy preferences were found to be consistent: respondents whose world views were environmentally oriented were more likely to prefer renewable energy options and energy conservation than were those respondents whose world views were more aligned with the dominant paradigm. The hypothesized causal link between environmental attitudes and energy preferences was expanded by incorporating

"reasons for choice" variables. It was found that the sequence of world views to reasons to energy preferences was logically and statistically valid among the public. Given that the same components were isolated in the energy scenarios, it was inferred that the above sequence was also valid for interpreting the forecast results. This finding allows for accurate comparisons to be made between the public and the forecasting agencies, and represents a step towards the understanding and empirical measurement of macro and micro processes.

Acknowledgements

I would like to thank my supervisor Dr. E.L. Jackson for all the time and effort he has spent on the thesis. I appreciate all of the help he has given during my residency at the university. Many thanks to are also due to Dr. O.F.G. Sitwell, Dr. R.G. Ironside, and Dr. A. Carlson for providing valuable comments and suggestions. Dr. S.M. Macey's involvement is greatly appreciated.

The following individuals and organizations provided financial assistance which greatly facilitated the research and writing of the dissertation: Mr. F. Mink of the Alberta Energy Resources Conservation Board; the Social Sciences and Humanities Research Council of Canada; and Dr. F.S. Chia, Dean of Graduate Studies, University of Alberta. Their help is sincerely acknowledged.

A particular debt of gratitude is due to my sister, Susan Kuhn, who provided assistance at a crucial time. Most of all, Wilma and Tara gave me support and encouragement throughout the years, and have made the road travelled a memorable one.

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1. INTRODUCTION

1.1 Introduction

In Canada, as in most other industrialized nations, oil is one of the major energy sources. Since 1970, however, additions to established reserves of crude oil have been declining steadily and have not kept pace with production in most years (Economic Council of Canada, 1985). This means that a transition from dependence on conventional oil is inevitable. Considerable debate has emerged over which options should be emphasized to replace conventional oil, and the long term energy supply alternatives available to Canada.

The vast majority of energy supply sources in Canada are derived from nonrenewable sources, mainly fossil fuels. With the exception of hydro-electric facilities, renewable resources play a minor role. Prior to 1973, the belief in virtually unlimited energy availability was largely uncontested. However, the OPEC oil embargo dramatically altered pre-1973 forecasts of plentiful oil supplies. Almost overnight energy became a major concern as world oil prices quadrupled. Price increases slowed economic growth in oil consuming nations because of the huge transfer of wealth to oil producing countries and the need to invest in energy conservation and expanded production of domestic supplies. Some countries, Canada included, chose to reduce the dramatic impact of higher prices by holding domestic prices below world levels. In Canada, lower prices provided a temporary competitive advantage but only at the expense of postponing adjustments to more efficient energy use that was dictated by the realities of the world energy market. When Canada finally did begin to move towards the world price of oil in 1981 and 1982 (after OPEC initiated a further trebling of oil prices in 1979), the price increases pushed up the general price level, kept inflation high, increased the degree of restraint needed to break the momentum of inflation, and thereby contributed to the worst recession since the 1930s (Carmichael and Herrera, 1984).

At present, depressed oil prices coupled with surpluses of oil and natural gas have resulted in a slowdown of economic growth and an increase in unemployment in energy producing regions, particularly in Alberta. This situation has also resulted in substantial

curtailments of investments and activity in the Beaufort Sea, east coast exploration and drilling, and oil sands development projects. Among the many lessons learned by the Canadian governments, industries, and the public in the turbulent years following 1973, perhaps the most important was the pervasive impact energy had on all facets of society.

Despite significant reductions in energy demand achieved over the past fifteen years, Canada remains one of the most energy intensive countries in the world in terms of per capita energy consumption (Economic Council of Canada, 1985). Coterminus with the reduction in the rate of demand has been a shift in Canadian energy markets, namely a substitution of energy sources to replace conventional oil. Most notably has been the greater role given to hydro, nuclear, coal, and bitumen in providing Canadian energy needs. Oil and gas from Arctic sources and from off the east coast are other potential supply sources generally favoured by governments and industries (Elder, 1984).

The emphasis on continued reliance on nonrenewable energy resources and the concomitant institutional and political structures needed to develop and market these resources has been criticized by a number of individuals and organizations who favour an energy future which stresses renewable energy and energy conservation (e.g., Brooks, 1981; Elder, 1984; Friends of the Earth, 1983; Hooker *et al.*, 1981). The underpinnings of their argument are based on the pioneering work of Amory Lovins (1977) who introduced the terms the "hard" and "soft" energy paths. Essentially, Lovins was opposed to three major aspects of energy development and use. He was against nuclear energy, which he considered uneconomic and proliferative. He was opposed to technocratic rule and governance by an elite, and he was opposed to the socio-political costs imposed by the increasing scale, vulnerability, and remoteness of large energy producing systems (Lovins, 1977; see also Morrison and Lodwick, 1981; Greenberger, 1983).

In general, advocates of the hard path favour increasing the supply of energy by developing nonrenewable energy resources through centralized organizations using high technology run by a technical and managerial elite. Soft path advocates emphasize reducing demand through energy conservation and promoting small scale, diverse, and renewable energy

resources. Fundamental to the soft path position is the argument that the ramifications of energy development and use (and hence energy policy) supercede strictly technical and economic considerations. Energy is more than just a resource, and the choice of an energy strategy reflects the fundamental values and attitudes held by society generally. Energy policy is therefore viewed as a technical means to providing social ends rather than an end in itself. In this context, energy policy not only has a role in providing society with sufficient energy, it also has a role in reinforcing and promoting desirable social directions (Crow *et al.*, 1978; see also Hooker *et al.*, 1981, Ch.9). Thus, what began many years ago as debate about technology, has expanded into a debate about social structures, economic principles, the quality of life, and values.

This raises the central issue of this thesis. It is becoming increasingly recognized that problems related to resource development and environmental degradation are related to attitudes and values, and to the institutions which reflect them. Indeed, numerous authors contend that the values and attitudes held within a society determine, to a large extent, its relationship to the environment and how resources are used (e.g. Cotgrove, 1982; Drengson, 1983; Dunlap and Van Liere, 1978, 1984; Sandbach, 1980; O'Riordan, 1976, 1986). On examination this contention is based on the premise that attitudes and values cause behaviours that are observable (Sitwell and Latham, 1979). Given that this is true, a change in attitudes and values will result in a change in behaviours which are also observable. Thus, if environmental and resource depletion problems are eventually to be better understood and solved, research concerned with the identification and dissemination of attitudes and values and their influence on perceptions, preferences, and behaviours is necessary. Cotgrove (1982, p. 25) aptly summarizes this view:

> The natural environment is more than simply an objective fact: it is experienced and given subjective meaning.... So it is not just the facts of pollution, or the reduction of known resources to which we must attend. We need also discover the underlying system of beliefs and values which provide the framework for interpreting the evidence. We need to discover and bring to light the implicit cultural significance given to some explicit condition of nature.

The systematic investigation of environmental attitudes, perceptions, and behaviours has been undertaken by geographers since the early 1960s. Although initial research efforts

were concerned with natural hazards (mainly floods), the framework of investigation was found to be applicable to a wide range of issues, including energy. Indeed, after the 1973 OPEC oil embargo, a plethora of energy-related studies was undertaken which incorporated measures of public perceptions and attitudes. Much of this research was motivated by the threat of oil shortages and by the realization that solutions to energy problems involved more than economic and technical considerations, which tended to focus on increasing energy supplies. Although the utility of the early investigations was questioned (Sadler, 1980), recent developments have led to a refinement in conceptualizing and measuring relevant dimensions of the energy issue among the public. There has been a movement away from relying on superficial measures of perception of energy issues or specific aspects of the energy issue (e.g. belief in the veracity of a "crisis") to the consideration of fundamental attitudes and values that underlie perceptions, preferences, and ultimately energy-related behaviours. A more thorough conceptualization of the energy issue than has characterized previous inquiries has also led to the application of increasingly rigorous methodologies to obtain and analyze questionnaire survey data, and the results from these studies are becoming more applicable to energy decision makers.

Despite these advances, two theoretical problems still remain to be resolved. The first, known as the "aggregation" problem, is related to the understanding of the dynamic relationship between the individual and society. The problem within behavioural geography has been to uncover this relationship in an empirically verifiable manner. The second problem is related to the relationship between attitudes and behaviours. Although only tenuous relationships have been uncovered in the past, recent advances have been made. Both of these issues will be addressed in this thesis.

Perhaps the most recent innovative development in terms of the measurement of environmental attitudes has been made by Dunlap and Van Liere (1978, 1984) who have measured attitudes in terms of "paradigms" or "world views". The use of the paradigm concept allows for the identification of a set of related attitudes and thus presents a more realistic and r[illegible]ble interpretation of people's relative position or stance towards

environmental issues and behaviours than has been provided in past research. Dunlap and Van Liere have coined the terms "Dominant Social Paradigm" (DSP) and "New Environmental Paradigm" (NEP) to represent two mutually exclusive world views. The DSP has been defined as "the constellation of common values, beliefs, and shared wisdom about the physical and social environments which constitute a society's basic 'world view'"(Dunlap and Van Liere, 1984, p. 1013). Generally, the DSP characterizes the major cultural values held by society at large (i.e. the *status quo*), which include faith in science and technology, support for economic growth, faith in material abundance, and the belief that nature can be "managed". The NEP is usually defined in terms of anti-DSP attitudes and values and embraces the concepts of "steady state", "limits to growth", and "spaceship earth". The energy paths defined by Lovins (1977) are in many respects analogous to the DSP and NEP. Indeed, it can be maintained that the hard energy path is not only compatible with, but stems from the tenets of the DSP, while preferences for the soft energy path depend, and require the acceptance of, the core values of the NEP. Previous research has established that such relationships are indeed evident among the Albertan public (Jackson, in press).

The use of paradigms as measures of deeply rooted world views can also be used to interpret behaviours. In other words, rather than starting from attitudes and attempting to understand behaviours or perceptions, behaviours can be examined and the underlying attitudes can be inferred. The paradigm concept will be employed in both manners in this thesis.

1.2 Thesis Objectives

The major focus of this thesis will be on long term energy development alternatives for Canada generally, and Alberta specifically. Alberta was focused on because it is the major Canadian producer of oil and gas, and any changes to energy policy will have dramatic effects on the province. A central assumption is that perceptions of and preferences for energy options and energy development scenarios are inextricably related to fundamental attitudes and values towards the environment and society generally. The paradigm concept of

environmental attitudes will be used to evaluate energy forecast scenarios and to measure public commitment to the hypothetical world views.

In order to make comparisons between the public and policy accurate, a detailed review and evaluation of four energy development scenarios (forecasts) will be undertaken. Two of the forecasts were published by government-affiliated agencies: the Economic Council of Canada (ECC, 1985); and the Alberta Energy Resources Conservation Board (ERCB, 1986). Energy scenarios submitted by two environmental organizations will also be evaluated: the Friends of the Earth, Canada (FOE, 1983); and the Alberta Environmental Network (AEN, 1985). The ECC and FOE studies were concerned with national energy development strategies, while the ERCB and AEN reports focused on Alberta. Each study will be evaluated in terms of the methodologies employed, the assumptions and objectives incorporated into the projection models, and the emphasis given to different energy supply sources. Based on the above, the extent to which each scenario represents the major tenets of the alternative world views will be outlined. This analysis will be undertaken in order to isolate the main aspects involved in the projection of Canadian and Albertan energy futures, as well as to provide a "context" within which to examine the public's view of future energy development alternatives.

An examination of public commitment to either the DSP or NEP will be undertaken. Respondents will be classified on the basis of their responses to a series of attitude statements. Relationships between world views and energy preferences for both the short and long term, and the reasons expressed for those preferences, will be examined. It is postulated that the "reasons for choice" variables will be related to environmental attitudes and energy preferences in a consistent manner. If this relationship is found to be statistically valid, it will contribute to an increased understanding of the causal relationships between attitudes and energy preferences. Moreover, by isolating the same variables for both the energy scenarios and the public in terms of future energy development alternatives, comparisons between the two will not only be simplified, but will also more accurately reflect the decision processes common to both.

Interrelationships between the public's environmental attitudes and measures of their societal values, energy policy objectives, socio-economic characteristics, and reported energy conservation practices will also be sought. The main intention here will be to isolate further areas of similarities and differences between individuals with contrasting world views.

Finally, the results from the above analysis will be discussed in relation to the theoretical problems in behavioural geography. Specifically, it will be maintained that the framework used in this study will contribute towards the solution of the aggregation and attitude-behaviour problems.

The major objective of this thesis is to apply the concept of environmental world views to evaluate and compare the long term energy alternatives for Canada and Alberta as outlined in four energy development scenarios (forecasts), and those favoured by a sample of the Alberta public. The specific objectives are as follows:

1. To review and analyze four energy development scenarios to determine the extent to which they represent the major tenets of either the Dominant Social Paradigm or the New Environmental Paradigm on the basis of the methodologies employed, the assumptions and objectives incorporated into the projection models, and the emphasis given to various energy options.
2. To verify the ability of an attitude scale to measure consistent dimensions of public environmental attitudes.
3. To determine the relationship between public environmental attitudes (i.e. support for the DSP or NEP) and preferences for short and long term energy options, and the reasons expressed for those preferences.
4. To determine the relationship between environmental attitudes, societal values, energy policy objectives, and socio-economic characteristics of the public.
5. To examine the number and type of energy conservation practices reported to have been adopted by the public and to determine the relationship with their environmental attitudes.
6. To determine if the causal relationship between environmental attitudes and energy

preferences can be expanded to include the reasons for choice variables in a statistically verifiable manner.

7. To compare public perceptions of future energy development with the four energy development scenarios.

To elicit data from the public, a self-administered questionnaire survey was designed and implemented. One thousand questionnaires were mailed to a random sample of households in Calgary and Edmonton in September, 1986. The effective response rate was 43%. Approximately 57% of the returns were from residents of Edmonton while the remaining 43% came from Calgarians.

1.3 Thesis Outline

In the next chapter, a review of behavioural geography will be undertaken. The focus is on energy perception studies and recent innovations in attitude measurement. A review and evaluation of four energy development scenarios comprises Chapter 3. The results from the questionnaire survey are presented in the following five chapters. Initially, the questionnaire design and implementation procedures are addressed (Chapter 4), followed by an analysis of energy perceptions (Chapter 5), environmental attitudes (Chapter 6), values about society and energy (Chapter 7), and energy conservation behaviour (Chapter 8). A summary and discussion of the major findings and suggestions for future research are presented in the final chapter.

2. GEOGRAPHY, ENERGY, AND ENVIRONMENTAL ATTITUDES

2.1 Introduction

Over the past twenty-five years, problems of decision making have been a focal point of research in the social and behavioural sciences. These topics and a method to analyze them were introduced to geographers by Gilbert F. White, who maintained that problems in natural hazards and resource management were amenable to formal and behavioural analysis. Indeed, he wrote in 1966 that "at the heart of managing a natural resource is the manager's perception of the resource and the choices open to him in dealing with it" (1966, p. 105). Central to White's research was the incorporation of the perceptions of individual "managers" in order to provide a better basis for individual and collective choice. Since the 1960s, the fields of environmental perception and behavioural geography have grown substantially, both in terms of methodology and subject matter.

In this chapter, the development of the behavioural approach in geography will be reviewed, emphasizing energy perception research. Recent developments in attitude measurement will also be outlined.

2.2 Behavioural Geography and Energy

2.2.1 The Introduction of the Behavioural Approach

Behavioural approaches to geographical investigation gained widespread acceptance during the 1960s. The emergence of this research perspective stemmed from a general dissatisfaction among some geographers with positivist investigations into spatial phenomena, and from the development of a behavioural approach in the social sciences generally. Thus, during the 1960s, a significant theoretical break occurred in human geography with the initiation of perception studies emphasizing the variable and contingent nature of the environment (Ley, 1981). The theoretical transition from environment to behaviour and then to landscape could not be accomplished by holding human values constant. In other words,

physical resources were not viewed simply as objective "givens" of the physical environment; they were objects endowed with meaning by a geographic subject (Ley, 1981). A unified "sub-discipline" of behavioural geography, however, did not emerge. Rather, two distinct schools of thought developed: the scientific-positivist, and the phenomenological-humanist. There were significant differences in philosophy and methodology between the two groups although they were united in their belief that:

> We must understand the ways in which human beings come to know and to understand the geographical world in which they live.... Such understanding is best approached from the level of the individual human being (Downs, 1981, p. 319).

The phenomenological-humanist position was adopted largely by cultural and historical geographers who emphasized the study of the "sense of place". This work, associated particularly with the writings of Tuan (1974, 1977) and Lowenthal (1961), sought to identify the dominant meanings of a place and the quality of geographical experience. An explicitly phenomenological perspective was claimed by Relph (1976) and Seamon (1979) in their landscape and sense of place studies; they emphasized the role of intuition, the discovery of meanings, and methodological subjectivity based on researchers' personal judgements. This perspective is best summarized by Lowenthal (1961, p. 259):

> Every image and idea about the world is compounded of personal experience, becoming and meaning. The place we live in, the realms of imagination, and fantasy, the places we visit and travel through, the world we read about, each contribute to our image of nature and man.

The alternative view of behavioural geography received more widespread acceptance. This position, labeled the scientific-positivist approach, was defined by Downs (1970, p. 68) as having the potential to be "the science of spatial behaviour and spatial decision making, a science committed to prediction and statistical explanation." Harvey (1969) maintained that this approach was subsumed by spatial analysis as an appendage to the locational school. Thus, despite some initial claims to the contrary, behavioural geography has retained strong ties with the positivist tradition in geography (Johnston, 1983). Within this framework the full force of the scientific method was applied in, for example, a preoccupation with measurement, operational definitions, and a highly formalized methodology.

It is within this context that behavioural geographers undertook the systematic study of specific environmental attitudes, perception, and behaviours. Attention here will be focused on the development of the behavioural approach in resource management studies, particularly natural hazards and energy.

The behavioural approach is an inductive one, or perhaps more accurately an empirical one, having the aim of building general statements out of ongoing processes. Much effort is spent on data collection because information is needed from individual decision-makers. The data, once collected, are aggregated in order to allow statistically substantive and significant generalizations to be made.

The foundations of this approach are based on the decision making theory advanced by Simon (1957) who introduced the terms "satisficing behaviour" and "bounded rationality" to counter the assumption of "economic rationality" prevalent in much research carried out at the time. The concept of satisficing behaviour, however, is a confused one as it can be given several meanings. For example, satisficing behaviour can be regarded as a form of optimizing behaviour in which the criteria used are non-economic (e.g. maximize leisure time). Satisficing behaviour may also be regarded as optimizing behaviour with respect to a number of preselected alternatives out of a much larger set of alternatives. As such, the concept of satisficing behaviour may refer to a decision maker's intuitive assessment of the adequacy of his preselection process. This definition is what Simon refers to as "bounded rationality". This theory posits that a decision-maker's "model" of the world encompasses only a portion of all relevant characteristics of the real environment and that inferences are based on only a fraction of all the relevant information present in that "model" (Harvey, 1969).

One of the first attempts by geographers to employ the behavioural approach was the series of investigations into human response to environmental hazards, initially floods, in the late 1950s and early 1960s (White, 1961). The decision making theory of Simon formed the basis of this approach and were used by Kates (1962) to develop a schema which has subsequently been shown to be relevant to a wide range of behaviours. The schema was, and still is, used in much geographical work in resource management and consists of four

components:

1. People are rational when making decisions but only in relation to the environment as it is perceived by the decision maker, which may be quite different from "objective reality".
2. People make choices, but many are trivial or habitual.
3. Choices are made on the basis of knowledge but only rarely can decision makers bring together all the information relevant to their tasks and frequently they are unable to assimilate and use all that they have.
4. Information is evaluated according to predetermined criteria; in habitual choice the criteria are what was done before, but in conscious choice the information must be weighted according to certain rules (i.e. satisficing).

The behavioural approach used by geographers to study human response to floods has been extended to numerous other areas of concern. Saarinen (1966) initially extended its use to investigate perceptions and attitudes towards drought on the American Great Plains. Since that time, behavioural geographers have studied numerous facets of man-environment relationships, including many aspects of natural and environmental hazards (Kates and Burton, 1986; White, 1974), risk assessment (O'Riordan, 1986), outdoor recreation (Jackson, 1985), energy scarcity (Jackson and Foster, 1982) and nuclear power (Zeigler *et al.*, 1981).

2.2.2 Energy Attitudes Research

The study of preferences, perceptions, and behaviours related to energy consumption and conservation largely began after the 1973 OPEC oil embargo. Much of the research was motivated by threats of oil shortages, with the corresponding realization that solutions to energy problems involved more than technical and economic prescriptions which have generally focused on increasing the supply of energy. Specifically, questions concerning public perceptions and attitudes towards energy resources and the diffusion and adoption of energy conservation practices among the public were addressed (Conn, 1983; Farhar *et al.*, 1980; Jackson and Foster, 1982; Stern and Aronson, 1984). Most studies were based on two assumptions: that people's perceptions of facts, not just facts alone, help shape public

opinion (Mitchell, 1978); and that the sucesss of government and industry efforts to stimulate energy conservation or other initiatives among the public will ultimately depend on explaining the relationships between perceptions and behaviours (Jackson, 1980).

Several consistent findings have emerged in energy attitude and perception studies (Jackson and Foster 1982). Four general findings will now be briefly addressed.

First, public reaction to the energy "situation" has been "crisis oriented"; individuals are only likely to alter their behaviour patterns when they perceive that the supply and availability of energy is immediately threatened. Results from numerous studies support this contention. For example, McDougall *et al.* (1980) found that Canadians generally did not perceive the energy situation as a serious one and hence adopted few practices to effect energy conservation. Related to this finding is the fact that individuals seem unprepared to make alterations to their general lifestyles. Cunningham and Lopreato (1973, p. 75), for example, found that "consumers are willing to make substantial efforts to conserve energy as long as they are not forced to spend substantial amounts of money or experience a negative impact on their lifestyles." Similarily, McDougall and Keller (1981, p. 13) argue that "while consumers have positive attitudes toward energy conservation and are engaging in a number of types of energy conservation behaviours, they are not willing to make substantial sacrifices which would affect current lifestyles." A study undertaken by Jackson (1980) in Alberta also reached this conclusion.

In general, individuals underestimate the risk and discount the impact of resource scarcities, at least until these reach crisis proportions. Nevertheless, the adoption of energy conservation practices by the public has been occurring. In Alberta, for example, Farbrother (1985) and Rodgers (1987) found that the majority of the respondents to their questionnaire surveys reported that they had adopted at least two energy conservation measures.

The second consistent result emerging from energy perception research is that individuals vary in their perceptions of, and preferences for, energy. A study of Canadian's perceptions of future electrical sources for the next twenty years, for example, found that oil and coal energy options were perceived as the least important, while hydro, solar, nuclear,

natural gas, and wind (in that order) were expected to be the major supply sources (Canadian Electrical Association, 1982). Farhar *et al.* (1980) and Brady (1980) found that the public would prefer energy programmes based on renewable resources, particularly solar energy, by the year 2000. Similarly, based on a review of four studies conducted in Alberta between 1981 and 1985, Jackson (in press) found a marked and consistent decline in preferences for fossil fuels from the short term (defined as "the next five years") to the long term (defined as "beyond the year 2000"). Nuclear power increased as a most preferred energy option between the short and long term. A substantial increase in the proportion of respondents most preferring solar energy was also found between the short and long term. In short, Jackson (in press) noted that a significant shift in public energy preferences was evident; while the majority of respondents most preferred nonrenewable energy sources (mainly fossil fuels) for the short term, renewable options and energy conservation were most preferred as long term energy options.

The third general finding from energy perception research is that individuals are rarely aware of all the alternatives to conserve energy, and only adopt a portion of the alternatives they know about. Empirical investigations supporting this contention are numerous. For example, Jackson (1980, p. 127-128) found:

> Energy conservation behaviour, like the process of adaptation to natural hazards, is characterized by a limited range of practices or adjustments perceived and adopted. No adjustment was part of the awareness-range of all people; no individual was aware of all the alternatives; and commonly, people adopted fewer adjustments than the range of which they were aware.

Farhar *et al.* (1980) in their review of energy attitude studies in the United States, also found evidence to indicate an "awareness-adoption" gap. They found that most people reported that they are practising some form of residential conservation behaviour and that the practices most frequently engaged in were "those that were the least inconvenient, costly, and effective"(1980, p. 15). As conservation measures increased in inconvenience and/or cost, they were practiced by fewer people even though the benefits of adopting the measures were known. Based on their review the authors were also able to conclude that the levels of technical knowledge concerning how to conserve energy effectively are low among the general

public. Indeed, many energy perception studies have reached this conclusion and commonly suggest increased government and industry efforts to inform the public on how and why to conserve energy.

The fourth general finding from energy perception research is that concern about energy is partially influenced by price. McDougall and Keller (1981) report that the reason for the substantial increase in the number of Canadians who consider energy as one of the major problems facing Canada is because of increasing costs rather than scarcity. This conclusion is reinforced by numerous studies, particularly those which have included analysis on the effects of socio-economic factors. A major factor often associated with the adoption of energy conservation measures is income. As Cunningham and Lopreato (1977, p. 92) state:

> Middle income consumers appear to be the most responsive to economic incentives to conserve energy. Price increases elicit the greatest conservation response from these consumers, while the lowest and highest income groups show less significant responses.

The four components outlined above, while distinct, are also strongly interrelated. For instance, the awareness and adoption of conservation practices are influenced by perceptions of key aspects of energy such as scarcity and price. Perceptions of resources and the environment differ among and between groups; the significance of such variations is that they constitute an important influence on behaviour. As Kates (1962, p. 1) has maintained, "the way men view the risks and opportunities of their uncertain environments plays a significant role in their decisions as to resource management."

Based on these relationships, it has generally been hypothesized that a relationship exists between attitudes and perceptions on the one hand, and behaviours on the other. It is argued that if individuals' attitudes, values, and perceptions concerning the environment are known, their behaviours toward the environment can be identified, understood, or inferred. Proposed solutions to a wide variety of environmental and resource depletion problems can then be formulated, in part, on the basis of this knowledge.

2.2.3 Problems in Behavioural Geography

The expectation of a direct causal relationship between perceptions and behaviours, however, was never completely fulfilled. Sadler (1980), for example, in his discussion of how questionnaire surveys could contribute to energy policy-making, concluded that they are "prone to elicit public preferences and attitudes that may be accurate but are only marginally relevant for predicting behaviours which have significance for policy" (1980, p. 186). Mercer (1984) also arrived at this conclusion, as did Desbarats (1983) in her review of attempts to establish a "subjectivity-behavioural" link with respect to spatial behaviour. Bunting and Guelke (1979) forcefully challenged the assumption of a simple relationship between perceptions and behaviours:

> In the first place, there is effectively no empirical evidence to substantiate a clear and direct relationship. On intuitive grounds alone it would appear that the practicalities of everyday activities preclude a simple one-to-one relationship (1979, p. 460).

The lack of relationship between attitudes and behaviours is pervasive in much of the empirical literature relating to energy perception research. For example, Jackson and Foster (1982, p. 18) state: "There is ... doubt about the extent to which both perceptions and behaviours can be explained with reference to attitudes." Although some correlations have been identified in the literature, some contradictory results are also evident. For example, McDougall *et al.* (1981) found no significant relationships between attitudinal variables and energy consumption/conservation behaviour in their cross-Canada survey. It should be noted, however, that the studies referred to above were reliant on relatively simplistic measures of environmental attitudes, and relationships with reported behaviours were normally sought on a one-to-one basis. Nonetheless, it can be stated that behaviours cannot always be predicted or understood on the basis of attitudes and perceptions alone.

A recent research strategy attempting to alleviate the attitude-behaviour dichotomy which is receiving some attention by geographers is provided by Ajzen and Fishbein (1980). Their "theory of reasoned action" consists of four equations linking behaviour with several psychological antecedents. By moving backwards from behaviour to intention, from intention to the corresponding attitudes and subjective norms, and from these to underlying beliefs and

values, the authors argue that increased understanding of the factors which influence behaviour can be gained. According to the theory, "intention is the immediate determinant of behaviour and thus allows us to predict behaviour" (1980, p. 90). However, the theory is only valid given a number of limiting stipulations. First, the model applies only to behaviours under the volitional control of the people in question. Second, the strength of the observed relationship is greatest when the measured intention corresponds to the observed behaviour in terms of action, target, context, and time. And third, the theory is only valid when nothing intervenes to alter intention between the time it is measured and the time the behaviour is observed.

Brown and Macey (1983) have applied Ajzen and Fishbein's theory in an attempt to understand residential energy conservation through the identification and measurement of attitudes and beliefs. Although the authors report some success, the use of the theory of reasoned action does not provide a useful framework for the present study because the limitations outlined above necessitate too narrow a focus in terms of topic and time frame.

A second major theoretical problem in behavioural geography concerns explaining and understanding the interrelationships between the individual and society. Within behavioural geography two positions can be identified which attempt to explain human behaviour. Those who view behaviour as a reflection of free will expressed through rational choices tend to seek explanations at the micro level and engage in disaggregate research. Those who stress the determination of human behaviour by the objective forces of social dynamics tend to seek explanations at the macro level and engage in aggregate research. These two positions are usually considered to be mutually exclusive (Desbarats, 1983; see also Cullen, 1976; Golledge, 1981; Pred, 1981; Sheppard, 1980). Modes of explanation emphasizing systems variables, however, are not necessarily incompatible with modes of explanation emphasizing individual variables.

> The two types of variables are intricately linked as it is the differential susceptibility of individuals to constraints that mitigates the effects of the systems variables. Appropriate aggregation procedures thus become the key to the study of constrained behaviour (Desbarats, 1983, p. 353).

The realization of such a methodology, however, is troublesome. Golledge (1981, p. 1333) remarks that it is "the most perplexing unsolved question facing the behavioural researcher today, for it requires an answer on both methodological and epistemological grounds and currently that answer does not appear to be readily found." Similarly, Keat and Urry (1975, p. 229) state: "The primary problem is how to develop theories that satisfactorily synthesize the structural analysis of different social formations, and explanations of human action in terms of subjective states and meanings."

The study of society, then, can be undertaken from two perspectives. One is concerned with the micro processes of social life, focusing on cognitive processes which underlie individuals' perceptions of and behaviour in society and the environment. A second approach, the macro perspective, is commonly understood as the study of society, of social institutions, and of socio-cultural change on an aggregate level. Concern here is with the totality of the political economy and its three elements: an ideology, a political system, and a socio-economic structure. This latter approach can entail the use of theoretical concepts on a systems level and the use of aggregate data derived from micro-level responses to characterize social collectivities (Knorr-Cetina, 1981).

Problems arise, particularily in behavioural geography, with reference to these perspectives (i.e. the aggregation problem) which are often thought to be incompatible. In practice, however, this dualism is arbitrary. As Pred (1981) has argued, in order to gain insight into individual behaviour, it is necessary to hold insights into the workings of society, and conversely, in order to gain insights into the workings of society, it is necessary to possess some insights into human behaviour. The separation of individual and society is an artificial one which has allowed researchers to probe into either the workings of society or individual decision-making processes as separate, and often unrelated, phenomena. The merging of the two "scales" of investigation, however, has become necessary if clearer insights into social and environmental problems are to be found. Indeed, the major research programme in the 1980s undertaken by social theorists and theoretically inclined geographers has been, and will no doubt continue to be, the bridging of this conceptual dualism.

2.2.4 Summary

Despite the problems outlined above, the study of environmental perception and behaviour has continued (Saarinen *et al*, 1984). The initial rationale or justification for the behavioural approach is still valid, namely that individuals' perceptions, attitudes, and values toward the environment and its resources are major and crucial factors for understanding environmentally-oriented behaviour. Previous research has demonstrated that failure to take into account the cognitive processes preceding behaviour may have resulted in the failure of various policy initiatives with respect to, for example, flood plain management or energy conservation strategies.

There is, however, much substance in the criticisms leveled at the behavioural approach. Part of the problem which may account for the lack of relationships between behaviour and preferences and the antecedent variables is that, for the most part, the latter have been defined and measured in terms of relatively superficial and volatile perceptions. Thus, a method of tapping more fundamental and stable influences, namely attitudes and values, is required.

Furthermore, empirical investigations of public attitudes and values have to be explicitly set in a larger social context so that factors that may influence public attitudes can be isolated (e.g. government policy, industrial development plans, energy forecasts). Only in this way can the actual dynamics of attitude formation and dissemination begin to be uncovered.

2.3 The Measurement of Environmental Attitudes and Values

2.3.1 Introduction

Behavioural geographic studies in the past have typically measured single attitudes and attempted to relate them to specific resource-related behaviours. As Bunting and Guelke (1979) have correctly pointed out, this is too simplistic a basis to understand or predict behaviours. Recent research endeavours undertaken by Dunlap and Van Liere (1978, 1984)

and Jackson (1985) to measure attitudes in terms of paradigms or "world views" represents an important step towards understanding the complicated interplay between man and the environment. The measurement of attitudes in terms of paradigms allows for the identification of a set of related attitudes and thus presents a more realistic interpretation of people's relative position or stance towards environmental issues and behaviours than has been provided in past research.

2.3.2 Paradigms and Society

The paradigm concept as advanced by T. Kuhn (1962) pertains to the advancement of science and changes in the structure of academic communities. It is therefore necessary to demonstrate the applicability of the paradigm concept to society as a whole.

According to Kuhn a paradigm is "what members of a scientific community share and conversely, a scientific community consists of men who share a paradigm" (1970, p. 460). A paradigm is a set of theoretical, methodological, and empirical procedures which are widely accepted within a scientific community. As well, a paradigm contains "universally recognized scientific achievements that for a time provide models and solutions to a community of practitioners" (Kuhn, 1962, p. x). Paradigms may refer simultaneously to two aspects of scientific achievement: first, to a body of content implicit in the achievement, and second, to a function of the achievement in the scientific community. The content is usually a diverse assemblage of law, method, and metaphysics (i.e. a general world view) associated with the paradigm. The function of the paradigm is its role as a focal point for the consensus of the scientific community. This consensus need not involve any explicit formulation of the paradigm's content but is rather a general acknowledgement of the exemplary role of the approach taken by the paradigm (Gutting, 1980).

A "paradigmatic shift" occurs when new problems arise which cannot be answered within the existing paradigm. This shift involves a change in fundamental assumptions or world views. As Berry (1978, p. ix) remarks:

> Led by a new paradigm, scholars adopt new methods, look in new places, and even see different things when looking with familiar methods in places they have looked

before. There is a gestalt switch that takes place all together or not at all.

The notion of paradigms developed by Kuhn with respect to science is also applicable to society as a whole. With respect to environmental problems and the future direction of Western society, the paradigm concept is particularly useful. A society which is operating fairly normally has its theory in the form of a dominant paradigm which, in the case of Western society, includes the idea that nature can be dominated, maintains an unbridled faith in the efficacy of science and technology, and promotes the production and consumption of material goods for consumerism and military ends (see Drengson, 1983; Leiss, 1974; Marcuse, 1964; Ophuls, 1977). A major contention made in this thesis, and indeed made by numerous authors, is that the current dominant paradigm is coming increasingly under attack because of its failure to cope with environmental and social realities. The attacks on the dominant paradigm resemble "extraordinary science" whereby new ideas, perspectives, and methods are applied to problems the existing paradigm cannot solve, thus initiating a paradigmatic shift.

As long as a society can handle its problems (or "puzzles" in Kuhnian terminology) and make minor adjustments in the dominant paradigm to accord with new "facts" brought about by social change, that society is proceeding in a way analogous to "normal science". As Kuhn has argued, when normal science is busily and successfully at work it tends to be impatient with philosophy or theory which have a tendency to question accepted assumptions and to reopen issues which were thought to be closed. In the eyes of normal science, philosophy appears as a potential distraction and diversion of energies away from "puzzle-solving" activity. Similarly,we may say that when societies are operating normally, they will evince little interest in philosophy except perhaps in a sceptical manner. Society too is more preoccupied with resolving the practical "puzzles" of growth and governance in accordance with the presrciptions of its dominant paradigm.

Throughout the history of Western society, we find that the major theories advocating social change have been produced during times of crisis, rarely during times of normalcy (Wolin, 1980). This suggests that the major social theories or paradigms resemble "extraordinary science": they are produced when the dominant social paradigm is experiencing

profound anomolies rather than puzzles. Furthermore, the major alternative social theories and paradigms exhibit the same features as extaordinary science in that they seek to discredit the existing dominant paradigm (eg. Marx's critique of capitalist society; environmentalism). Obviously, no one will pay much attention to these attacks if they are content with the existing paradigm.

The emergence of the "environmental movement" in the 1960s represents a paradigmatic shift, at least among its hard-core followers. Advocates of environmentalism share a set of values and attitudes that are incompatible with the *status quo*, arguing that the normal procedures are inadequate to cope with environmental and social problems. Cotgrove (1982, p. vi) has summarized this position as follows:

> The environmentalist movement has provided a focus for the expression of discontents with many of the central features of industrialized society-centralization, a growing sense of helplessness in the face of impersonal bureaucracies, and the growing influence of experts in decisions involving complex technologies. Environmentalists do not share in the dominant faith in science and technology, and in the economic individualism of the marketplace.

2.3.3 Delineation of Environmental Paradigms

The measurement of environmental attitudes in terms of paradigms necessitates the formulation and definition of at least two mutually exclusive positions. The terms "Dominant Social Paradigm" (DSP) and "New Environmental Paradigm" (NEP) are usually employed. The DSP has been defined as "the constellation of common values, beliefs, and shared wisdom about the physical and social environments which constitute a society's basic 'world view'" (Dunlap and Van Liere, 1984, p. 1013). Generally, the DSP characterizes the major cultural values and attitudes held by society at large.

The NEP is less easy to characterize and define precisely because it has not yet come into being. As a result, the determination of relevant criteria is open to researchers' interpretation of what constitutes a NEP. Usually, the NEP is couched in terms of anti-DSP attitudes and values and embraces the concepts of "steady state", "limits to growth", and "spaceship earth".

The use of these classificatory devices is not new. For example, O'Riordan (1976) distinquished between technocentric and ecocentric modes of environmentalism. Technocentricism (or DSP) represents the application of "value free" scientific and managerial techniques by a professional elite in a "neutral" environment. Progress, efficiency, rationality, and centralization form the basic ideology. Furthermore, it is contended that man is able to understand and control events to suit his own ends as can be noted in the belief that through the application of science and technology, humankind can "manage" nature. Ecocentricism (or NEP) on the other hand is described as "resting upon the supposition of a rational order in which all things move according to natural laws, in which the most delicate balance is maintained" (1976, p. 1). Its proponents argue for low impact technology, they decry bigness and impersonality in all its forms, and demand a code of behaviour that seeks permanence and stability based upon ecological principles of diversity and homeostasis.

A classification scheme which parallels that developed by O'Riordan has been advanced by Lovins (1977), who introduced the terms "hard" and "soft" energy paths. The hard path is characterized by technologically sophisticated and centralized nonrenewable energy sources such as nuclear power, oil and natural gas, oil sands and coal, and is based, for the most part, on the generation of electricity. The soft path is characterized by the use of renewable energy sources (e.g. solar, wind, biomass) and places heavy emphasis on energy conservation and the decentralization of energy generation.

Other analogous classification frameworks include Drengson's (1983) distinction between technocratic and planetary-person paradigms, Naess's (1973) shallow and deep ecology dualism, and Russell's (1979) expansionist/limited-world dichotomy. Fundamental to all of these schemata (however labelled) is the identification of two mutually exclusive positions. O'Riordan (1982, p. 103) succinctly summarizes this view:

> Environmentalism [i.e. the NEP] cuts across established ways of tackling economic and social developments. It challenges conventional approaches in economics, the law, politics, technological assessements, and public attitudes as to what is valued. Environmentalism cannot be 'added on' to existing practices: it demands a fundamental restructuring of a whole philosophy and strategy.

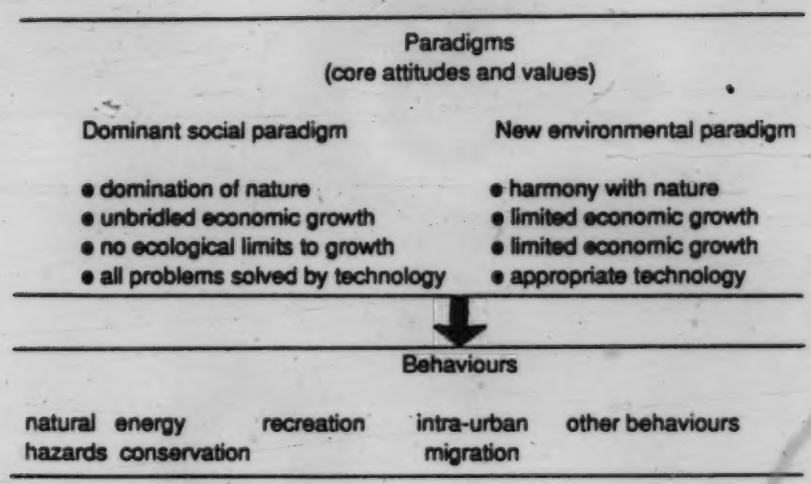
The similarity between the NEP and what Kuhn describes as extraordinary science thus becomes clear. The NEP challenges the very roots of the DSP, arguing that the DSP is incapable of solving the deeper environmental dilemmas facing society as these problems have ceased to become "puzzles" and represent, instead, "crises".

2.3.4 The Measurement of the DSP and NEP

Commitment to either the DSP or NEP is contingent on the acceptance or non-acceptance of a number of attitudes, values, and beliefs. Consequently, a series of statements which represent the fundamental aspects of each paradigm can be formulated and used to measure individuals' adherence to either the DSP or NEP. Responses to these statements can then be grouped and individuals classified on a "DSP-NEP continuum". Relationships between various behaviours and "worldviews" can then be sought. The use of paradigms represents an improvement over previous studies of environmental attitudes. It offers a more comprehensive and realistic perspective on the relationship between attitudes and behaviours. The argument presented here posits that if individuals' core attitudes and values can be determined and classified on the DSP-NEP continuum, their general behavioural orientation to, and preferences for, a number of diverse activities and options can be understood. The assumption that attitudes and behaviours are related on a one-to-one basis is therefore dropped (Figure 2.1).

The use of paradigms as measures of deeply-rooted worldviews can also be used to interpret behaviours. In other words, rather than starting with attitudes and attempting to understand behaviours, we can examine behaviours and attempt to understand the underlying attitude and value systems the behaviours reflect. This perspective applies particularily well to the study of the generation and use of energy where the behaviour is readily observable (e.g. energy forecasts, government legislation, policy, and industrial strategies). In this context, the general orientation of society can be classified and individuals can be seen as microcosms of the larger social structure, reflecting, or opposing, the dominant social paradigm.

FIGURE 2.1
PARADIGMS AND BEHAVIOURS



The measurement of attitudes and values in terms of paradigms was begun by Dunlap and Van Liere (1978, 1984). They constructed two scales to measure the DSP and NEP. The NEP scale consisted of 12 items covering a range of environmental issues--pollution, population, and natural resources (Dunlap and Van Liere, 1978, p. 11). The DSP scale was more comprehensive in that 37 items were included. Eight general "dimensions" emerged after their results were factor analysed: support for laissez-faire government, support for status quo, support for private property rights, faith in science and technology, faith in material abundance, faith in future prosperity, support for economic growth, and support for individual rights (Dunlap and Van Liere, 1984, p. 1020).

Results from initial research undertakings using the paradigm concept are encouraging. For example, Dunlap and Van Liere's (1984, p. 1023) results "strongly support the hypothesis that commitment to the DSP leads to lower levels of concern for environmental protection." Similarly, Jackson (1985, p. 17) has found that "values and attitudes [when

measured in terms of paradigms] represent a powerful influence on the development of perceptions and preferences towards energy conservation and the choice of desirable options for Canada's energy future." For example, Jackson (1985) found that 82 per cent of ecocentrists favoured the soft energy path, especially solar energy, while 78 per cent of technocentrists favoured the hard path, with the main emphasis on nuclear power. Further evidence of the utility of the paradigm concept is provided by Jackson (in press) in his review of four studies conducted in Alberta between 1981 and 1985. He found that preferences for the soft energy path were more frequent among those portions of the samples defined as ecocentrists, while hard path energy options were preferred by the majority of respondents identified as technocentrists. Consistent, and statistically significant, results were found in each of the four studies.

2.4 Synthesis

Recent developments in research by geographers and other social scientists on aspects of the public's response to energy issues have been based on the recognition that some means must be found to measure people's fundamental attitudes and values. It is now believed that these, rather than the more volatile and ephemeral perceptions of energy problems, have the greatest influence on individuals' preferences and expectations, and ultimately their energy related behaviours. The measurement of environmental attitudes in terms of paradigms or world views provides a useful framework to determine individuals' relative position or stance towards a number of aspects of the environment and society. The paradigm concept also provides a framework within which to examine policy and development scenarios.

The concept of environmental world views will be applied in two separate analyses. First, four energy forecasts will be reviewed and evaluated in terms of the methodologies employed, the assumptions and objectives incorporated, the emphasis given to various energy options, and the extent to which they represent the major tenets of either the DSP or NEP. Two of the forecasts are national in scope (Economic Council of Canada, Friends of the Earth, Canada), while the remaining two focus on Alberta (Energy Resources Conservation

Board, Alberta Environment Network). This analysis will be undertaken to provide a "context" within which energy decisions are made, as well as to isolate the major components involved in the projection of Canadian and Albertan energy futures.

An examination of public committment to either the DSP or NEP will comprise the second major part of the thesis. The measurement of attitudes will allow respondents to be classified as either technocentrists (DSP) or ecocentrists (NEP). It is expected that the latter group will be more supportive of renewable energy options and energy conservation measures than will those identified as technocentrists. Relationships between environmental attitudes and the reasons identified as important for supporting (or not supporting) different energy options will also be sought, as will associations between environmental attitudes and societal values, socio-economic characteristics, and energy policy objectives as perceived by the public.

By isolating the major components found in the energy forecasts and among the public with respect to energy development and use, it will then be possible to analyse both in an analogous manner in order to establish areas of disagreement and congruence. In other words, two "levels" of social phenomena will be examined in a parallel manner: the components involved in the determination of energy scenarios (macro-level) will be compared to the components involved in individual's energy preferences (micro-level) through the application of a common conceptual framework (environmental world views). If it is found that individual's energy preferences are related to their reasons for choosing a specific option which in turn are related to their world views, and given that the same components were isolated in the energy scenarios, it could then be inferred that the same sequence as found among the public is also valid for interpreting the results of the energy scenarios. Furthermore, comparisons between the two will more accurately reflect the actual processes involved. The overall aim, then, is to examine the relationship between the forecasting agencies and the public in order to work towards the resolution of the aggregation problem in an empirical manner.

3. ENERGY DEVELOPMENT SCENARIOS

3.1 Introduction

Energy forecasts, which are attempts to provide guidelines about, and projections of, possible futures, are indispensible to contemporary energy policy- and decision-makers. As Cross has stated: "It is possible to forecast without planning but it is not possible to plan without forecasting" (1975, p. 2). However, energy forecasts to date have generally failed to project energy supply and demand patterns accurately, or foresee economic, political, and technological conditions even in the relatively short term. Nevertheless, forecasts continue to be made and used because decision-makers need to know the likely consequences of policy initiatives and decisions, potential energy demand and supply patterns, and the like.

In this chapter, four energy forecasts are reviewed. Two are national in scope: one prepared by the Economic Council of Canada (1985) the other by the Friends of the Earth Canada (1983). Two Alberta forecasts are also considered: the Energy Resources Conservation Board's (1986) latest report as well as one submitted by the Alberta Environmental Network (1985).

Once reviewed, the studies are evaluated in terms of the methodology and assumptions they incorporate, their proposals for facilitating the transition from conventional oil, and the extent to which they reflect the alternative world views (DSP-NEP) reviewed earlier.

3.2 Economic Council of Canada

Connections: An Energy Strategy for the Future

3.2.1 Introduction

The Economic Council of Canada (ECC) has a mandate to analyse and advise on national and regional economic issues. It has both an advisory and educational role. In its advisory role, the Council generates information and ideas for policy-makers, parliamentary and legislative committees, and the private sector. In its educational role, the Council

publishes both technical and policy-oriented documents directed towards a wider audience.

3.2.2 Background

Connections was published in 1985, after the dissolution of the National Energy Programme and at the end of a decade of high energy prices in Canada. The Council, recognizing the complexity and interrelatedness of energy decision-making and policy, has sought to outline a policy within a consistent strategy that reflects various concerns: "the security of energy supply, economic efficiency, sustained economic growth, and increased Canadian ownership and control of the energy industry" (ECC, 1985, p. ix). The issues believed to be the most fundamental for the next ten to fifteen years were focused on. Topics not considered in the report included the "downstream" energy industries (e.g. petroleum refining, petrochemicals), the nuclear industry, environmental issues, and the question of native land claims.

According to the Council, the "public interest" in Canada has not been well served by the current policies applied to various energy sectors at both senior levels of government. Specifically, it thinks that "Canadian energy policy has tended to fly in the face of economic forces in an effort to juggle too many issues" (Copithorne and MacFadyen, 1985, p. 373). Numerous distinct goals were pursued by a number of policy initiatives, including the development of resources, income redistribution, increased Canadian ownership, healthy public finance, job creation, regional development, and anti-inflation measures. The Council believes that greater prominence should be assigned to the goals of economic growth and development in the formulation of energy policies, stressing the efficient management, development, and use of Canadian energy resources. The design of such alternative policies requires the recognition of three economic realities (ECC, 1985, p. 1):

1. The effects of domestic oil pricing flow through to all areas of industry and have an important impact on the development of labour and capital, international trade and financial flows, indeed, on the whole economy.
2. Energy markets are highly responsive to economic factors such as prices; they respond

slowly, but they *do* respond. Energy demand decreases when consumers face higher costs, and energy supply increases when producers receive higher returns.

3. Resource management is complex, involving the ordering and pacing of development, as well as the measurement and sharing of resources.

Current policies, it is argued, do not pay sufficient attention to these realities. Under the approach recommended by the Council, the cornerstone of energy policy would be to allow domestic energy prices to reflect economic values to a much greater extent than in the past, together with "sensitive adjustments to other worthwhile objectives" (ECC, 1985, p. 1). Thus, Canadian prices for crude oil, natural gas, coal, and electricity should be aligned with the world price of crude oil, subject to the specific supply and demand situation of each specific energy form. The deregulation of energy prices would induce increased energy production on the one hand, and energy conservation and the choice of least-cost energy fuels on the other. Subsidy and grant programmes would, as a result, be substantially reduced.

The principal objective of the proposed energy strategy is "the same as that of any drive for greater economic growth and development, in this case, to make the maximum contribution that energy policy can be expected to make towards raising the per capita income of Canadians" (ECC, 1985, p. 1). This goal would be accomplished through more efficient resource management which in turn would result in increased investment, stimulating energy supply, curbing energy consumption, and forcing the development of alternative energy sources.

Fundamental to the proposed alternative is that more consideration than has been given in the past be directed towards longer-term economic goals. However, the Council does not advocate a strategy based purely on the functioning of economic forces in the markets for energy. Although market forces would play a preeminent role, government action in a number of areas is still seen as a necessity (e.g. regulation of electrical utilities and pipelines, ensuring competion and stability in the delivery of energy products and services, controlling exports, promoting research, etc.). In the Council's words, "such intervention is consistent with a policy in which more efficient management (and thus maximum economic growth) is

the central thrust" (ECC, 1985, p. 2).

According to Copithorne and MacFadyen, the theoretical underpinnings of the Council's policy package are "very standard welfare economics" (1985, p. 374). To maximize the welfare of the people living in a market economy, the economy must run efficiently and income redistribution has to be "fair" or equitable. Economic efficiency requires the appropriate pricing of energy, and prices must be allowed to act as market signals for this efficiency to be maximized. Equalization payments (or other forms of revenue sharing) must be formulated to cope with the ever-changing and evolving pattern of regional income disparities.

Prior to evaluating specific energy resources, *Connections* focuses briefly on the policy setting of Canadian energy decision making, recognizing that many elements are involved. These include the "ambiguities and overlaps in jurisdiction over the oil and gas industry, the centrifugal forces of regional disparities, the wide diversity of provincial interests, national concerns about economic stabilization and regional economic development, the provincial and national search for energy security, the instability of world oil prices, foreign ownership of Canada's oil and gas companies, and finally, the constraining drag of the [then] existing petroleum agreements upon policy change" (ECC, 1985, p. 25). It is clear, therefore, that energy policy must integrate a wide variety of political, social, and regional concerns. The Council believes that a coherent strategy must, above all, incorporate the realization of the economic potential by creating policy that encourages both efficiency and entrepreneurship.

3.2.3 Results

The emphasis on economic efficiency is maintained in the Council's review of Canada's oil, natural gas, and electricity supply. With respect to oil, the Council is supportive of pricing domestic oil at the prevailing world price. They argue that the supply of oil is responsive to economic incentives and can be affected by policy. Policy, therefore, should not attempt to promote one source of supply over another but rather, should "provide a decentralized framework of incentives for industry to explore and develop those sources

whose social supply costs are below the world oil price" (ECC, 1985, p. 53). In other words, although recent perceptions of where Canadian supplies will come from in the medium term have leaned towards nonconventional and frontier sources, the Council maintains that the conventional oil supplies from the Western Sedimentary Basin should be depended on until well into the 1990s. Given adequate economic incentives, reliance on this region for the majority of Canadian oil supplies, it is argued, is well justified.

Although oil and gas share a number of similarities in an economic sense, there are marked differences between the two energy sources: the pricing of gas is based on a continental supply/demand situation rather than on the world market; there is a high level of regulation and costly transportation for gas; and gas exports play an important role (ECC, 1985, p. 70). Perhaps the most significant difference between oil and gas is that the latter is, at present, characterized by a large excess supply. The Council favours a policy of price deregulation in order to provide consumers with lower gas prices and to promote off-oil goals. Therefore, it is the Council's position that long term benefits to Canada would not be maximized by limiting production and keeping the gas in the ground for future needs and price increases. Rather, production at present can generate net revenues that can be reinvested in the economy to trigger a chain of investment and income generation over time, including replenishing the resource base. Consistent with this strategy, the Council emphasizes increasing exports of natural gas, particularly to the United States.

The Council is generally supportive of recent policy changes affecting natural gas, particularly the widening of the gas/oil price gap, lowering the export price, increasing export licences, and expanding the domestic market (ECC, 1985, p. 70). The above measures are consistent with the Council's belief that natural gas, like other energy resources, should contribute the largest economic benefit possible to Canada at the least cost. In the Council's words (1985, p. 70): "Greater interaction between buyers and sellers in the domestic market, in parallel with the recent changes in export policy, would afford better use of Canada's natural gas potential over both the short and long term."

For the most part, the electricity sector is publicly owned and regulated. The industry has developed not only as a supplier of energy concerned with the efficient management of resources, but as an instrument of social and economic development (ECC, 1985, p. 71). Although economic efficiency has been a genuine concern, the Council maintains that it has often had to make way for other social and economic goals of government. The sense of social purpose continues to be reflected in the management and regulation of the electric utilities. Electricity is viewed by many as a motor of modern technology and industry and thus continues to be perceived as a primary instrument of economic development. To encourage this, one of the main objectives of the provincial governments (the owners of the electricity sector) has been to ensure the lowest possible rates to residents and industries of the province. The Council believes, however, that in many provinces electricity rates have been kept much lower than is warranted from the strict point of view of economic efficiency. They suggest that there is a need for more comprehensive regulation of this sector because of the industry's growing role in the economy both domestically and with respect to exports. To accomplish these objectives, the Council recommends the establishment of formal regulatory bodies in each province to review and determine electricity prices (including rate levels and structures) and to monitor capital investment. They would also like to see more emphasis placed on economic efficiency where the priority would be to "bring the revenue requirement in line with a more competitive return on capital and other resources devoted to electricity supply" (ECC, 1985, p. 96). The Council also emphasizes the need to integrate export policy and domestic supply policy, particularly as exports to the United States are expected to increase in the future. Under current conditions, profits from external sales of electricity are used to subsidize domestic consumers thereby leading to increased demand and inefficient electricity use.

Energy demand, conservation, and substitution are considered in the penultimate chapter of the report. The Council recognizes that "energy demand in industry, in buildings, and in transportation is significantly responsive to the price of energy and that it can be responsive to policy. Canadians have learned, in effect, that energy demand is malleable"

(ECC, 1985, p. 99). Adjustments in energy demand, however, can be slow because structural changes are often required to bring about significant reductions and cannot be implemented rapidly. As a result, "the short-run demand for energy is less flexible (less 'elastic') than the long-run demand" (ECC, 1985, p. 99). Nevertheless, over the past decade, price fluctuations, varying rates of economic growth, continuing technological advances, and government intervention have resulted in changes to the patterns of energy demands in all sectors and regions in Canada. Between 1973 and 1983, for example, the rates of growth of demand in Canada averaged less than one per cent a year whereas they previously fluctuated around six per cent per year. These changes in demand rates have also confirmed the ability of government policy to effect changes in consumer attitudes and choices. Programmes have contributed to the replacement of oil by natural gas, electricty, or some alternative energy sources in homes and industry, and to energy conservation in all sectors of economic activity. The Council, however, believes that the role played by government could have been left to the market if prices had reflected the real cost of the competing options:

> Extreme efforts were necessary to convince energy users to conserve energy because prices were kept artificially low in order to meet other government objectives. It is highly likely that a policy taking greater account of the responsiveness of demand to prices would, to a large extent, have achieved the desired results at a lower cost to government and, in the long run, to consumers as well (ECC, 1985, p. 121).

The Council, however, does not propose that the government should refrain from influencing energy demand. Indeed, they argue that government policy can be an efficient factor in leading consumers towards economic energy options through the dissemination of information, by providing financial assistance in selected cases to accelerate the introduction of energy technologies, and by supporting research and development in the many areas of conservation and alternative energy sources. The first requirement, however, is to "recognize fully the capacity of the market to adjust to a changing environment" (ECC, 1985, p. 122).

3.2.4 Conclusions

In the final chapter of *Connections* twenty-nine policy recommendations in nine general areas are proposed: sharing the resource rents; management of energy resources;

consultation; security of supply; petroleum and natural gas pricing; natural gas transport; petroleum taxes and incentives; electricity regulation; and conservation and substitution of alternative energy sources. The general thrust of these recommendations is to develop and manage Canadian energy resources in the most efficient and economic manner. The mechanisms of the free market are viewed as the most effective means for achieving this objective. Nevertheless, the Council recommends that the federal government should continue to provide incentives in certain areas. For example, they recommend that the federal government provide moderate incentives towards the exploration for oil and gas in the Canada lands until 1990, at which time the desirability of further incentives would be reassessed (Recommendation 6). Similarly, they also recommend that the federal government should continue to support the nuclear electric power industry until 1990 (Recommendation 24).

The Council recommends that the government redirect their strategy of active support for energy conservation and alternative energy supplies (Recommendation 27). Instead of extensive subsidy programmes, they maintain that limited administrative and/or financial participation in demonstration projects should be supported. These programmes should be aimed at economically promising technologies that face specific, clearly identified market barriers.

With respect to the pricing of Canadian energy supplies, the Council is supportive of using the world oil price in marketing Canadian oil (Recommendation 7). They also recommend that the price of natural gas be decontrolled (Recommendation 8). With respect to electricity, the Council recommends that time-of-use rates be implemented gradually (Recommendation 20), and that provincial governments investigate the applicability of marginal cost principles to the pricing of electricity within their jurisdiction (Recommendation 21). As a result, it is hoped that improved efficiency and greater fairness in electricity pricing would be achieved. In fact, the general direction of public policy in the electricity sector is that users should be charged all the economic and noneconomic costs incurred to meet their demands for electricity. Thus, the Council calls for the gradual elimination of subsidization of domestic electricity prices (Recommendation 25).

The Council also recognizes that the public should have some participatory role in selected energy decisions. They recommend that representatives of industry, the various interest groups concerned with energy conservation and alternative energy sources, and governments should identify the most effective means to inform decision-makers of the benefits of conservation and substitution investments (Recommendation 26). With respect to "conventional" energy sources, however, it is recommended that a Council of Federal and Provincial Energy Ministers be established and that it hold formal conferences on at least an annual basis as a means of improving cooperation (Recommendation 3).

3.3 Friends of the Earth Canada

2025: Soft Energy Futures for Canada

3.3.1 Introduction

The Friends of the Earth (FOE) in Canada analysed the feasibility and implications of an energy future based "primarily upon efficiency in energy use and renewable energy supplies rather than upon increased growth in energy demand and continued reliance upon nonrenewable supplies" (FOE, 1983, p. 1). The study was not meant to be predictive in the sense of attempting to discover or describe the most likely energy future for Canada. Rather, four questions were posed and considered:

1. How technically feasible is a renewable energy future?
2. How economically viable?
3. What would it look like?
4. What would need to be done were we to try for such a future? (FOE, 1983, p. 1).

The base year of the investigation was 1978 while the end point was the year 2025. The results of the study were submitted to the federal government in the summer of 1983. The twelve volume report concluded that, on the basis of a detailed province-by-province analysis, soft energy paths were both economically efficient and technically feasible under conditions of strong economic growth and substantial increases in material standards of living.

3.3.2 Background

Soft energy paths are energy policy paths or strategies directed towards achieving principal reliance upon soft energy technologies which in turn are defined by six characteristics: 1) renewability; 2) diversity; 3) flexibility; 4) matched in scale to end use needs; 5) matched in quality to end use needs; and 6) environmentally and socially benign. These characteristics are relative, not absolute; the main goal or objective is to move towards energy systems that are "softer" than existing systems.

Besides focusing on the areas of energy conservation and renewable energy resources, soft path analysts also adopt the methodological approach known as energy backcasting as opposed to the more traditional supply and demand forecasting techniques. Backcasting begins with the postulation of a particular future and subsequently analyses whether or how it can come about given present circumstances. Thus, the results consist of conclusions regarding the feasibility of such a future rather than on the likelihood of its occurrence. Backcasts, then, are prescriptive: working backwards from a particular chosen future to the present in order to determine what policy measures would be required to reach that future.

An important, if not central, component of the type of future the authors regard as feasible is one which places a premium on environmental quality and the decentralization of energy generation. Indeed, some energy options were precluded at the outset because they did not meet these criteria:

> Certain energy options, such as Arctic oil and new nuclear power stations, were excluded from the analysis, and other options, such as large-scale hydro projects, were de-emphasized. In other words, the study represents a backcast of a future society in which these options would not be available and in which conservation and decentralized renewable energy would be developed to their economic potential (FOE, 1983, p. 10-11).

The economic projections used were developed by Statistics Canada. Specifically, the Long Term Simulation Model (LTSM) was used to represent the Canadian economic system. In the model, emphasis is placed on physical flows of materials including the "ability to obtain resources, the techniques involved in their transformation and the need to dispose of wastes, rather than on price and income characteristics" (FOE, 1983, p. 19).

Population characteristics to the year 2000 were incorporated into the LTSM. In the projection, Canada achieves the replacement level total fertility rate of 2.1 by 1991 and net migration to Canada is assumed to average 100,000 persons per year. For the purposes of the study, the same rates of population and migration increases were continued after the year 2000 in order to project the results to 2025.

With respect to economic growth, two scenarios were adopted in order to provide a range of results. The first, entitled the "Business as Usual" scenario (BU), maintains modest rates of output growth, disposable income, and technological development. Consumer expenditures are projected to shift from durable goods to services over time. The second scenario, entitled "Consumer Saturation" (CS), incorporates the same assumptions about growth potential and technology but in this case some of the gains from technology are taken in the form of reduced labour time rather than increased expenditures on services. Thus, the projected output does not grow so rapidly as in the BU scenario.

The two scenarios "bracket" a range of moderate growth possibilities under assumptions about the nature of industrial production and the use of consumer incomes. The BU scenario does not represent an all-out growth scenario nor does the CS scenario represent a conserver society.

Both scenarios incorporate relatively buoyant economic prospects. Full employment and higher levels of per capita income and consumption of material resources are assumed. For the BU scenario, a 2.6% annual growth rate in the economy is projected and full employment is maintained by keeping paid working hours per person-year constant. The CS scenario, with 1.9% annual growth, trades leisure for income so that paid working hours per person-year decline about 30%. Both scenarios are similar to Canada today, "highly urbanized, with private automobiles as a major means of transportation, and with similar governmental and industrial arrangements" (Robinson, 1984, p. 6).

A number of other assumptions were incorporated into the study, most of which tended to "bias the results against soft energy paths" (FOE, 1983, p. 271). No major changes in values and lifestyles were assumed despite the long time horizon of the study.

Population and economic growth rates were chosen at the high end of Statistics Canada's projections. The social and environmental costs of competing fuels (considered higher for hard path options) were ignored, and only modest reductions in the real cost of soft energy technologies were assumed. Furthermore, the study did not consider a range of societal changes, such as increased recycling and product durability, district heating, changes in urban form, or major shifts to more energy efficient transportation modes. Thus, the soft energy scenarios do not represent a maximum use of renewable energy and conservation technologies; instead, they are "'soft' within what amounts to a worst-case scenario for development and within conditions of buoyant economic and consumption growth" (Robinson, 1984, p. 6).

Energy supply and demand options were analysed in terms of their technical and economic potential, where technical feasibility was defined with respect to the availability in 1980 of prototype or off-the-shelf technology, and cost effectiveness was defined in terms of the long run marginal costs of alternative ways of supplying energy. No renewable or conservation options were included in the scenarios unless they were cheaper than the projected long run marginal costs of oil and natural gas.

A fundamental principle of soft path studies is to treat all energy as if priced at its long run marginal cost or at its replacement value (FOE, 1983, p. 31). As a result, all forms of energy (old, new, renewable, nonrenewable) are treated as equivalent, as are investments in conservation (valued in terms of avoided expenditures to buy energy), and those in new energy production. An important assumption the authors make is that "an economically efficient pricing regime for conventional energy resources is in place, and that decisions are based on those prices rather than on today's [1983] prices" (FOE, 1983, p. 31). In other words, the analysis is based on the real long run cost of these energy resources. Although social and environmental costs of energy production and use are acknowledged to be widespread and high, no attempt was made to incoroprate them. This omission, it is argued, more strongly favours conventional, centralized, nonrenewable forms of energy than it does conservation and decentralized, renewable energy forms.

The pricing assumptions used by the authors were based on figures from the federal department of Energy, Mines, and Natural Resources in 1978, a time of inordinate optimism about future price forecasts. For natural gas and crude oil, real cost increases of 3% per year were assumed for 1981 to 2000, and of 1.5% per year thereafter. For electricity, real cost increases of 2% per year were assumed from 1981 to 2000, and of 1% per year thereafter. These projections, as it turned out, were considerably higher than those submitted by other agencies. For example, Canadian oil and gas prices assumed in the FOE report for the year 2000 were, respectively, 70% and 140% greater than those assumed by the National Energy Board (NEB, 1984).

3.3.3 Results

1) Demand

According to the authors, Canada in the year 2025 could use significantly less energy than it uses today at less cost to consumers. Furthermore, the majority of energy supplies would be derived from renewable sources and would provide increased employment opportunities, greater security, and fewer environmental impacts than those associated with fossil fuels and nuclear power. In fact, the results imply that there will be no domestic demand for Arctic oil production, or for new nuclear capacity beyond facilities that were operating or committed in 1978. The main results are summarized as follows:

> Under conditions of strong economic growth (an increase of more than 200% in GDP) and moderate population growth (an increase of over 50%), it would be technically feasible and cost effective to operate the Canadian economy in 2025 with 12% less energy than it requires today, and over the same 47 year period, to shift from 16% reliance on renewable sources to 77%. In addition, should the economy grow by 'only' 140% to 2025 (with the same population growth), and should the real cost of soft energy technologies drop slightly, it would be feasible and cost effective to use 34% less energy in 2025 than in 1978, with 82% of that energy provided by renewable resources (FOE, 1983, p. 11).

Thus, despite sustained economic growth and modest population increases, energy needs in the year 2000 would only be marginally greater than those of 1978 provided that cost-effective conservation measures are implemented (BU scenario). Secondary energy use would peak about the year 2000 and would then decline so that the overall trend between 1978

and 2025 is negative. If economic growth is cut back and modest lifestyle changes are introduced (CS scenario), secondary energy growth will be negative over the entire study period. In other words, low or negative energy growth does not depend upon, or result in, declines in the economy or productivity. Rather, it depends exclusively (in the BU scenario) and largely (in the CS scenario) upon gains in energy efficiency which have "the same positive economic effects as gains in labour productivity" (FOE, 1983, p. 85).

Total secondary energy use by sector was examined in order to arrive at the overall figures. Within the residential sector, energy consumption will drop to just over half its 1978 level by 2025. Most of the decrease will be the result of vastly improved energy efficiency levels in new housing stock as well as from retrofitting older dwellings. Space and water heating will also become more energy efficient. The mix of fuels in the residential sector will change from an emphasis on natural gas, petroleum products, and electricity in 1978, to an increased role for wood (25% of space and water heating in both scenarios), and electricity as a back-up heat source in solar and energy efficient homes (between 23% and 25%). Natural gas will provide 18% to 25%, active solar over 15%, biogas between 8% and 13%, and petroleum less than 5% in each scenario by 2025.

Energy use in the commercial sector will decline between 28% and 50% over the study period despite strong economic growth and large increases in activity. A shift away from fossil fuels used for building and water heating towards increased use of electricity will occur. As in the residential sector, gains in energy efficiency will be the most instrumental in decreasing energy requirements.

By the year 2025, the industrial sector will consume almost half of all secondary energy in Canada. In 1978, this sector accounted for over a third of all secondary energy use. It is also the only sector where all energy qualities (e.g. low temperature to high temperature heat) and all energy forms are used. For the BU scenario, growth of secondary energy use will increase by 1.6% per annum between 1978 and 2000 and decline by 0.8% per annum thereafter until 2025. Energy use will decline throughout the study period in the CS scenario by 0.9% per annum. Electricity is expected to provide approximately 20% of the total energy

demand in the industrial sector throughout the study period in both scenarios. The use of biomass (mainly wood) will increase dramatically so that by 2025 it will be the most important supply source (mainly as a result of increased efficiency which will reduce the demand for other fuels).

The final sector examined was transportation, which accounted for 25% of Canadian energy use in 1978. Road transportation accounted for the largest share of total energy use (82%). Although this sector's use of energy grew faster than did total energy use during the 1960s and early 1970s, the authors' projections have the situation reversed for the duration of the study period. Energy use in both scenarios will decrease steadily despite substantial increases in automobile use and commercial passenger and freight services. Greater levels of efficiency of automobiles will be the main reason for the decrease.

According to Robinson (1984, p. 8), the general lesson of the demand analysis is that "substantial amounts of savings due to improved energy productivity are cost-effective in all sectors, and can offset projected growth in sectoral activities."

2) Supply

According to the authors' projections, a major shift in energy from nonrenewable to renewable sources is possible. The major supply sources considered will now be briefly reviewed.

Electricity. Hydro-electric power will account for 87% to 90% of total electricity production by 2025. Wind, solar photovoltaic cells, and biomass sources will supply the remainder. Potential sources such as wave energy, solar "power towers", and geothermal steam were not included because they were either too expensive or technically limited. Similarly, hydrogen was ruled out because there was no electricity source inexpensive enough to make production competitive.

Uranium and Fossil Fuels. By 2025, the use of uranium to generate electricity (mainly in Ontario) will be completely phased out. In both scenarios, the use of coal will increase from 2% to 8% of secondary energy use although actual production levels will drop slightly. Natural gas will provide between 6% and 10% of all secondary energy in 2025

compared to almost 25% in 1978, while petroleum use will decline to just a few percentage points of the 2025 total. Two new oil "megaprojects" will be required to meet interim demand around the year 2000. At the end of the study period, petroleum will be used mainly as a feedstock for chemicals, fertilizers, plastics, and other nonenergy products.

Biomass. Biomass is by far the most important renewable energy resource for Canada. In fact, energy from biomass is expected largely to replace the fossil fuels by 2025. In 1978, biomass supplied about 4% of Canadian energy supplies, predominantly in the forest products sector. By 2000, biomass solids (i.e. wood chips and pellets) will account for 13% of total demand and will be used mainly for low-temperature residential heat and mid-temperature industrial heat. In 2025, the use of biomass solids will rise slightly to 17% of total demand while biomass fluids (i.e. methanol and ethanol) will account for 33% of energy use. Total biomass use in 2025 will account for half of the total energy demand.

3.3.4 Conclusions

Given the general thrust of the study, it is not surprising that the share of energy supplied by renewable forms will increase markedly over the study period. Indeed, excluding hydro and other renewable sources of electricity, the share of renewable energy starts at 4% in 1978 and will grow to 56% by 2025 in the BU scenario and to 60% in the CS scenario. Of the total, active solar energy will provide approximately 7% of secondary use. The use of biomass solids will increase between three and four times up to 2000 but little thereafter either absolutely or relatively. The most significant change occurs with respect to biomass fluids (mainly methanol) which start at nil but by 2025 will supply over a third of total secondary use in both scenarios. Thus, one of the principal results of the study is the gradual substitution of renewable biomass for nonrenewable crude oil.

The shift to greater reliance on renewable energy sources is even more marked if the share of electricity supplied by renewable sources (i.e. hydro) is added to the other renewable options. In fact, the total share of energy supplied by renewable sources thus calculated will grow from 15% in 1978 to 43% in 2000 and 77% in 2025 in the BU scenario, and to 83% in

2025 in the CS scenario. Thus, the transition is a gradual one; by 2000 renewable sources will provide less than half of the total supply. Only by 2025 will the energy system become dominated by these fuels.

The transition to a soft energy path in Canada would have significant economic, social, and environmental implications. The major impacts are outlined in the final chapter of the report.

Economic impacts.

Three major economic impacts are identified. First, the soft energy path outlined above would "create more employment and require less capital (and hence be less inflationary) per unit of energy produced or saved than would alternative hard path approaches" (FOE, 1983, p. 225). Secondly, there would be major changes to Canadian industrial structures and regional development with the emergence of new industries devoted to energy conservation and the delivery of renewable energy services, a decline in traditional energy industries, and a greater dispersion of the energy industry generally. Thirdly, with the projected decrease in demand for energy generally, and fossil fuels specifically, surpluses of natural gas and electricity could be exported at considerable economic gain to Canada. The implementation of cost-effective measures to achieve greater energy efficiency are also projected to increase the productivity and international competitiveness of Canadian industry.

Social impacts.

Although the authors acknowledge that the social implications of a soft energy path are difficult to identify, they maintain that its adoption in Canada would tend to support "urban versus suburban living, cultural diversity, and, by implication at least, greater frugality and what might be called an 'environmental consciousness'" (FOE, 1983, p. 228). Local self-reliance and increased opportunities for small businesses are also expected to be enhanced. Problems could arise with the implementation of a soft path due to "time lags between the impact of higher energy prices [due to the implementation of marginal cost pricing measures] and the effectiveness of conservation programmes, from capital barriers that limit the opportunities to save energy, from institutional problems, from employment

losses as megaprojects are cancelled and industries relocate, and from land use changes" (FOE, 1983, p. 229).

Environmental impacts.

With the exception of biomass harvesting, the authors maintain that "there is no question that short term and long term environmental threats would be greatly reduced under the soft path scenarios... as compared with harder alternatives" (FOE, 1983, p. 229). Substantial reductions in energy demand would be a major factor towards mitigating environmental damage resulting from any form of energy production and use. Reduced demand would also mean decreased reliance on fossil fuels so that oil from the Arctic would not be required, that the use of coal and synthetic oil would only increase slightly, and that nuclear power would be phased out. These energy sources are viewed by the authors as those which cause the greatest environmental damage during their development and use. Among the fossil fuels, only natural gas will contribute substantially to energy supplies at the end of the study period.

The reduction in energy use coupled with increased dependence on renewable resources and improved combustion techniques will reduce the severity of environmental impacts. Specifically, it will mean:

> ...a reduction in acid rain, no increase in carbon dioxide, and lower sediment and chemical loads in water courses. In addition, the need for certain contentious forms of land use, such as northern pipelines and very high voltage transmission lines, would be reduced compared with the situation under higher energy growth (FOE, 1983, p. 229).

Concern over the large scale production of biomass (e.g. wood energy plantations, soil erosion, excessive runoff, nutrient depletion) was expressed by the authors although they cite evidence that "biomass can be harvested on a large scale without environmetal damage" (FOE, 1983, p. 231). Nevertheless, the implementation of biomass sources in this study was kept slow in order to enable further research, development, and demonstration to be conducted to ensure that appropriate environmental management and land use practices will be available and used.

3.4 Energy Resources Conservation Board

Energy Requirements in Alberta: 1986-2010

3.4.1 Introduction

The Energy Resources Conservation Board (ERCB) is required, among other things, to provide "an appraisal of the requirements for energy resources and energy in Alberta" (ERCB, 1986a, p. vii). Energy requirements are reviewed formally every three to four years. The report considered here, entitled *Energy Requirements in Alberta: 1986-2010*, is the fifth undertaken by the Board since 1971. The report (released in October 1986) was originally planned to be released in early 1986. However, the dramatic, and largely unforeseen, collapse in world oil prices necessitated a reassessment of the assumptions and estimates contained in the original forecast.

3.4.2 Background

The Board issued a public notice requesting interested parties to submit their views of which changes they felt should be made to the previous (1982) forecast. A total of thirteen submissions were received from various corporate organizations (e.g. Shell Canada, Petro-Canada, CP Rail) as well as from the Alberta Environmental Network and the Small Power Producers of Alberta. The data submitted by these organizations were considered in the Board's forecasting models. Three models (Macro Economic, Energy Price Forecasts, Energy Requirements) as well as several submodels were all components of the Integrated Model of Alberta developed by the ERCB. The Integrated Model consists of 1500 endogenous and identity equations. The techniques used to estimate the equations were "econometrics engineering, accounting, market information, and consultation with private industry and government departments" (ERCB, 1986b, p. 125).

To estimate future energy requirements, a distinction between primary and secondary energy needs to be made. Primary energy resources include "natural gas as the marketable output of gas processing of dehydrating facilities, clean coal, bitumen and crude oil as they

enter the pipeline system, natural gas liquids, and renewable forms of energy such as hydro, wood, wind, and solar" (ERCB, 1986b, p. 1). Alberta's primary energy requirements are the energy resources used to satisfy the needs of Alberta consumers and industries. They include both the energy resources processed in the province to produce other products (energy and non-energy products) and energy resources used in Alberta that do not require prior processing.

Secondary energy consists of fuels used by consumers to generate, for example, heat, cooling, light, and motion. It includes electricity, natural gas, refined petroleum products, (e.g. gasoline, heating oil), renewable forms of energy, coal, as well as fuels used to transport energy from the point of production to the end user. Petrochemical feedstocks and other non-energy uses are excluded (ERCB, 1986b).

The magnitude of Alberta's energy requirements is influenced by numerous factors. Six were singled out as being the most important (ERCB, 1986a, p. 3): energy prices; industrial activity; upgrading of energy resources in the province; efficiency in the use of energy; the number of people residing in Alberta; and government policies. All of these factors are highly interrelated. The past trends of each of these factors over the past fifteen years (1971-1985) were reviewed by the Board prior to preparing the final results. Energy prices and industrial activity were shown to have increased at varying rates throughout the period. The upgrading of Alberta energy resources has also increased substantially while energy consumption per capita in the residential and commercial sectors increased continually during the 1970s, peaked in the early 1980s, before declining gradually up to the present. These latter developments were caused by large increases in energy prices and various government policies and programmes introduced to encourage increased efficiency in the use of energy. With respect to the number of people residing in the province, the Board notes that Alberta's population increased rapidly over the 15 year period with the greatest rate of growth occurring from 1977 to 1981. Since that time, population has remained roughly constant. In terms of government policy, the Board only notes that governements have "adopted policies which encourage efficiency in the use of energy, reduced dependence on

imported crude oil, and the development of alternative energy technologies" (ERCB, 1986b, p. 6).

It is against this background that the forecast for the next twenty-five years was conducted. A two-step procedure was used to estimate long term requirements. First, a profile of the main factors expected to influence energy requirements significantly over the forecast period was established. These profiles were then applied in order to arrive at the estimated requirements for various end-use categories. Both steps will now be reviewed.

3.4.3 Energy Requirement Factors

1) Energy Prices. International oil prices were used as a basis for estimating energy prices in Alberta. Due to the enormous uncertainties surrounding oil prices, the Board adopted a price band (high and low "scenarios") with the lower part of the band representing the Board's best judgment. The use of a "band of possibilities" provides some degree of flexibility for measuring the impact of future developments provided that variations in actual prices fall within the band. The current over-supply of crude oil is expected to be "corrected" by the mid-1990s and possibly before that time. Beyond the year 2000, prices are expected to increase slowly in real terms, reflecting the costs of developing new supplies.

2) Industrial Activity. Energy prices have had, and will continue to have, a major impact on the exploration and development of energy and on the energy industries themselves, and therefore affect the overall level of economic activity in the province. Although total energy production is expected to be about the same throughout the forecast period, major changes are forecast with respect to the mix of energy production. While conventional oil represented about 30% of total production and bitumen approximately 10% in 1985, almost the converse is expected by 2010; conventional oil will make up 10% of total production, bitumen 39%.

The gross domestic product (GDP) is used as a broad indicator of industrial activity. The Board expects several years of negative GDP growth before recovering in 1989 if oil prices follow the projected lower trend. If crude oil prices recover in the 1990s, Alberta will

experience an average economic growth rate of 2.4% per year throughout the decade.

Industrial activity is also measured in terms of the expected level of investments in the energy industry. The Board, assuming that no major changes will occur to present government policies, predicts that the next oil sands mining project will not begin until the early 1990s and that construction of two bitumen upgraders will not commence until the late 1990s. Both projects require vast capital expenditures and investments. Although growth in the petrochemical industry is expected to slow down over the next few years, by the late 1990s substantial new investments will then be made in this industry. The Board notes, however, that government policies designed to foster more rapid development could have a significant impact in the timing of these investments.

3) Upgrading Resources. Requirements for processing energy resources in the province are expected to increase markedly in the late 1990s when new oil sands mining projects are assumed to be in operation. The processing of crude oil will remain at about current levels.

4) Efficiency in Energy Use. Energy requirements per unit of output will be significantly reduced in the residential, commercial, and transportation sectors as a result of improved efficiency. Indeed, the Board projects a continued decline in the per capita consumption rate for residential and commercial end users. For transportation, per capita rates will decline until 1993 and then begin to increase due to increased use of transportation services. In general, efficiency improvements are expected to result in secondary energy requirements in these sectors being thirty per cent less in 2010 compared to 1985 levels. The potential for improved energy efficiency in the industrial sector is not considered to be very substantial.

5) Population. The Board predicts that the Alberta population will increase at an average rate of 0.9% per year during the forecast period. The population of Alberta in 1985 was approximately 2.4 million and is expected to increase to just under 3 million by 2010. Total population is a principal determinant of housing stock which in turn plays a dominant role in establishing residential energy requirements.

6) Government Policies. For the duration of the forecast period, the Board has assumed that current policies, including royalty and fiscal regimes, will continue to be in effect. In other words, no major policy initiatives are assumed.

3.4.4 Energy Requirements

1) Secondary Energy

Secondary energy requirements in Alberta are forecast to increase by 1.7% per year (900 PJ[1] in 1986 to 1350 PJ in 2010). The demand for natural gas is expected to grow at 2.1% per year on average. Its share of the total secondary energy market will increase from 52% to 56%. The main reason for its growth will be to supply the increasing requirements for natural gas in bitumen production and upgrading. Due to increased efficiency expected in the residential and commercial sectors, the use of natural gas will not grow significantly despite the growth in the number of residential units and commercial floor space. Natural gas use is expected to double in the transportation sector by the end of the forecast period.

Refined petroleum products will continue to capture a declining share of the secondary energy market because of expected improvements in the overall efficiency of gasoline use in motor vehicles. Demand for aviation turbo fuel will increase on average by 3% per annum to 2010.

Electricity is expected to maintain its overall share of the secondary energy market, with the highest growth rate occurring in the industrial sector. Although electricity requirements will be lower than in the past due to lower economic growth in the province, the demand for electricity is projected to increase on average by 3.4% per year between 1986 and 1990 for the low oil price case (5.1% per year for the high oil price scenario). Over the entire forecast period, the average annual growth rate is expected to be 1.7%.

In sharp contrast to the residential, commercial, and transportation sectors, industrial energy requirements are expected to more than double by 2010 and total more than 50% of total secondary energy needs (compared to 36% in 1985). More than 85% of this increase will

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[1]Petajoules

be attributable to increased bitumen production and upgrading.

2) Primary Energy

Alberta's total primary energy requirements are expected to increase by 74% between 1986 and 2010. The rapid increase relative to secondary energy requirements will be due mainly to the increasing needs for bitumen and natural gas feedstocks to produce synthetic crude oil. In 2010, conventional crude oil will account for 14% of Alberta's primary energy resource requirements, bitumen 38%, natural gas and natural gas liquids 35%, coal 12.5%, and hydro and wood less than 1%. The market share of crude oil will drop by 5% while that of bitumen will increase by 12% over the forecast period. Primary demand for natural gas (including gas liquids) and coal will both decrease as percentages of total demand (-5.3% and -2% respectively). Hydro and wood are expected to contribute a relatively small amount to the overall primary energy market throughout the forecast period.

A number of "alternative energy sources" were also considered by the Board in terms of their potential to displace the conventional primary energy resources. The specific sources considered were woody biomass, coal liquefaction, municipal waste (solid and liquid), geothermal energy, and "other sources" (e.g. animal wastes, energy crops). With the exception of woody biomass used by the forest industry, the role of alternative energy sources in the province is expected to be small given the Board's forecast for conventional fuel prices and assuming no technological breakthroughs.

3.4.5 Conclusions

The Board concluded their report by outlining four major implications their forecast would have on Alberta.

1) Depletion of Alberta's energy resources.

By 2010 the Board expects that conventional oil production will be about one-third the 1985 rate. In other words, by the end of the forecast period the conventional oil industry will be in the later stage of development. The productive capability of gas will also be in the decline phase by 2010 but production is expected to continue at substantial rates for several

decades in the upcoming century. Both coal and bitumen production rates are forecast to increase substantially throughout the forecast period. Although production will be large, the implications in terms of resource depletion will be minimal because of the huge resource base.

2) Significance of the shifting importance of specific energy resources.

As noted earlier, there will be a major restructuring in the relative importance of specific energy resources. While conventional oil and gas currently account for almost 85% of total energy resource production, their share will be only 50% by 2010 (natural gas will account for two-thirds of that share). Bitumen from oil sands operations and coal production will make up the remaining 50%. Because of high production costs associated with bitumen and coal, the shift in emphasis to these resources is expected to have significant implications for sustaining economic prosperity in the province.

3) Reduced growth in electricity requirements.

The lower levels of economic activity recently occurring in the province have resulted in lower growth in demand for electric energy. Since 1971 total electricity generation has been growing at an average rate of 8% per year. It is expected that the average annual growth rate for the twenty-five year projection period (1986-2010) will be approximately 1.7%.

4) Increasing importance of industrial requirements.

The current trend of increased industrialization in the province is expected to continue throughout the forecast period. As a result, industrial requirements will account for almost all of the increase in secondary energy requirements (36% to 53% from 1986 to 2010). Energy resources required for processing and upgrading in the primary energy category are expected to increase by approximately 80%.

3.5 Alberta Environmental Network

Conservation and Renewables for Energy Requirements in Alberta: 1985-2010.

3.5.1 Introduction

The Environmental Resource Centre, representing eight Alberta environmental organizations (collectively known as the Alberta Environmental Network (AEN)), submitted a report to the ERCB in October 1985 to assist the Board in updating its twenty-five year forecast of Alberta's energy requirements (reviewed earlier in this chapter). The study itself was based on a modified version of the methodology employed for the Canadian Soft Energy Path study by the Canadian Friends of the Earth (1983) which was also summarized above. As was the case with the FOE report, "particular attention [was] paid to the efficient use of energy resources, to the need for the inclusion of good environmental management in the energy industry, and to the potential use of energy resources which are viable over a long period of time" (AEN, 1985, p. 2). The primary criterion for the selection of secondary forms of energy and their sources of supply was, in all cases, cost effectiveness.

3.5.2 Background

Four characteristics were outlined which, the authors argue, set this study apart from the more traditional Alberta energy forecasts. Each will be briefly reviewed.

1) Demand orientation. The demand for energy can be seen as the demand for goods, services, transportation and the like which in turn need energy. The study, therefore, focused on how to meet these "real needs" in the most cost effective manner rather than focus on energy demand *per se*. The amount of energy required was determined by assuming its efficient use. Thus, energy conservation played a major role in determining the amount of energy use in the forecast. Conservation measures were only considered if they yielded the same (or greater) benefits to Albertans at a lower cost.

2) Energy quality. Energy quality was the measure of the "amount of useful work which a given form of energy can perform" (AEN, 1985, p. 3). Five classes of energy usage

were used: electricity specific; liquid fuels; and high-, intermediate-, and low-temperature heat. This taxonomy allowed the authors to "match" energy sources to end use needs in terms of the quality of energy required.

3) Environmental concerns. A number of environmental constraints and concerns were incorporated into the analysis. Specifically, they addressed nuclear power (precluded), limits on large scale hydro development (e.g. Slave River development rejected), concerns for atmospheric emissions, biomass considerations (promote renewable energy but exclude wildland areas as a source of wood), and demand reduction.

4) Energy pricing. When energy is priced at its long run marginal cost (or opportunity cost) it is used in the most economically efficient manner. In the study, the authors assume that these cost concepts were adequately reflected by the market clearing price despite the fact that some forms of energy were sold to consumers at substantially less than opportunity cost (mainly natural gas and electricity). The ramifications of this assumption were that "the same prices which influence development of one energy source will also influence the use of that energy source as well as the development of its substitutes" (AEN, 1985, p. 4).

As noted above, the method used in this study was adapted from that undertaken by FOE (1983). For the economic growth and population forecasts the Business as Usual scenario and its linked population projection were used. Population was forecast to be just over 3.8 million in 2005 and 4.1 million in 2010, while the GDP was expected to increase by 4.5% per year until 2000 and then fall to just over 1.3% per annum until 2010. These estimates were acknowledged to be somewhat high, which, the authors maintain, would result in an overestimation of energy use. Similarily, the projected energy prices used in the study were substantially higher than the other forecasts submitted to the ERCB. Specifically, crude oil prices were forecast to increase by 2% per year so that prices in the year 2000 were expected to be just under 40 dollars per barrel in 2000 and approximately 72 dollars per barrel in 2010.

3.5.3 Results

In general, the authors conclude that "the Alberta economy could grow substantially with no increase in energy use to the year 2010 and with a significant shift towards renewable sources of energy supply" (AEN, 1985, p. 67). To establish projected supply and demand patterns, secondary energy use in Alberta was disaggregated by sector (i.e. residential, commercial, industrial, transportation) and by thermodynamic quality (e.g. electricity specific, liquid fuel). The main results will now be reviewed.

Demand

Secondary energy use will decline substantially in both the residential and commercial sectors due to reductions in low-temperature heating needs and through increased efficiency and conservation. The reduction in demand will occur despite increases in population, the number of dwellings, and commercial activity. Electricity specific demands in these sectors will increase marginally throughout the study period.

With the exception of agriculture, energy demand in the industrial sector (e.g. iron and steel, food processing, pulp and paper) is expected to increase between 1985 and 2010 (from 136 PJ/a[2] in 1983 to 179 PJ/a in 2010). Although energy demand in the agricultural sector will decrease during the same period, it will not be enough to offset the overall increase in demand for the sector as a whole.

With the exception of a small amount of electricity used for urban transit, all transportation energy in 1985 consisted of liquid fuel. This situation was assumed to continue throughout the forecast period. For the transportation industry, which excludes private automobiles, energy use is expected to increase throughout the study period. Almost all of the increase is in the form of liquid fuel for the air and truck subsectors. For automobiles, a substantial decrease in energy demand is expected due mainly to increased fuel efficiency and less so to a forecast decrease in the average distance driven per capita per year. The results for the combined transportation sector indicate that total fuel use will rise as the increase in the transportation industry's fuel use will slightly more than offset the decrease in automobile

[2]Petajoules per annum.

fuel use.

In summary, total secondary energy use in Alberta will decline during the forecast period. The authors summarize the major findings as follows:

> Total energy use of 678 PJ/a in 1983 increases to 696 PJ/a in 1990 and then declines to 644 PJ/a by 2010. The growth of electricity-specific demand is primarily the result of such growth in the commercial sector. Liquid fuel use remains virtually constant....There is a modest increase in the demand for high- and intermediate-temperature heat in industry. Demand for low-temperature heat is reduced drastically through reduced requirements in the residential and commercial sectors (AEN, 1985, p. 44).

Supply

In this section of the report, the supply of energy forms to meet the demand for secondary energy in Alberta was calculated. New energy sources were introduced only after they became cost effective compared with forecast prices of conventional energy sources. In general, natural gas and refined petroleum products were projected to continue to supply the bulk of Alberta energy, although the use of each fuel will decline and be displaced by biomass solids (e.g. wood chips) and biomass fluids (e.g. methanol).

As was the case with the demand-side analysis, the determination of supply needs was broken down by sector. Natural gas is expected to continue to provide low-temperature heating needs throughout the study period in the residential sector. Biomass solids (mainly wood chips), however, will make a substantial market penetration, particularly a[illegible]00. Electric heating is also forecast to increase modestly as is the use of active solar for water heating.

A number of energy sources are expected to meet the low-temperature heating needs of the commercial sector. Biomass solids (wood chips) will supply 25% of total requirements by 2010 while the use of refined petroleum products will be phased out over the same period. Geothermal, active solar, and heat pumps collectively will provide about 10% of total requirements in 2010. Natural gas and electricity will make up the remainder.

For the industrial sector, excluding the pulp and paper subsector, refined petroleum products will be phased out by 1990 for all heating requirements. Biomass solids will begin to replace conventional sources for low-, intermediate-, and high-temperature heating needs by

1990 and by 2010 will supply 15%, 12%, and 5% of all heating needs respectively. Except for some high temperature heat supplied in the form of electricity, the balance of energy requirements will be met by natural gas. For the pulp and paper industry, biomass solids will continue to provide virtually all intermediate-temperature heat needs as they did in 1983. Natural gas will supply the balance of energy requirements.

As was the case with the other industrial subsectors, the use of refined petroleum products to supply low-temperature heat needs in the agricultural sector will be phased out by 1990. By the end of the study period, biomass solids will provide 20% of total demand with the remainder to be supplied by natural gas. With respect to liquid fuels, propane, compressed natural gas, and methanol and ethanol will account for 40% for total needs by 2010 with the balance derived from refined petroleum products.

In 1983, refined petroleum products accounted for 100% of total supply in the transportation sector. By 2010 their contribution will decline to 82% as a result of the penetration of biomass fluids (accounting for 13% of the total) and propane and compressed natural gas (5%).

The analysis presented above did not incorporate energy use required by the conventional energy supply sector. A "simple" treatment of energy use in this sector was conducted to obtain the "modified" secondary energy use. Noting that total energy use in Alberta will remain essentially constant, the authors assumed that, with the exception of electricity, energy use in the conventional energy supply sector will remain fixed both in terms of quantity and in form over the study period. Thus, use of refined petroleum products and natural gas and natural gas liquids will remain constant, while electricity use will increase from 28 PJ/a in 1983 to 35 PJ/a in 2010.

3.5.4 Conclusions

In general, a substantial shift in secondary energy use by form is projected. Although petroleum products and natural gas will continue to supply over half of the total Alberta demand in 2010 (30.3% and 33.6% respectively), biomass solids (10%) and biomass fluids

(5%) will begin to make substantial gains. Active solar and geothermal energy will account for almost 6% of total secondary energy demand by the end of the study period.

Conservation efforts and the implementation of cost effective energy efficient technologies are projected to result in an overall reduction in energy use in Alberta. Although the contribution of renewable energy resources will be relatively small over the forecast period, their use is expected to increase over time. In other words, the authors have outlined the beginning of a transition which, in the decades following 2010, will see the "completion of these shifts from conventional energy sources to the sustainable energy sources of the twenty-first century" (AEN, 1985, p. 68).

3.6 Methodologies

In this section, the methodologies used in developing the different energy futures are discussed. Some of the limitations of the different methods are also outlined.

A thorough critique of energy forecasting in Canada has been undertaken by Robinson (1982). He argues that, despite attempts to make them more accurate, traditional energy forecasting techniques are, and will remain, limited, because of the problems inherent in the techniques themselves and the institutional contexts within which they are applied. Robinson outlines three arguments to support his view. First, forecasts are inherently conservative because they are by necessity based on the extrapolation of past trends and the assumptions made by the forecasters who eschew explicit incorporation of normative judgments. As a result, forecasts tend to produce images of the future strongly biased towards the *status quo*.

A second limitation of forecasts, which also lends to their conservative bias, is that the use of past trends and relationships to predict future events means that there is insufficient basis for the inclusion of entirely new variables (e.g. solar energy, biomass), which thus tend to be underestimated or ignored. This can result in the somewhat ironic situation where an energy source would have to be used for a number of years before its use could be forecast (Robinson, 1982).

The third major reason for the limitation of forecasts is that they are critically dependent on the initial assumptions made by the forecaster. The methodologies used to forecast are vehicles for determining the consequences or implications of core assumptions which in turn reflect a particular view of society. Energy forecasts are therefore subjective and conditional statements, and can perhaps be best envisaged as "suggestions about what supply industries and governments are prepared to attempt to provide under the conditions and relationships between users, producers, and governments they have implicitly assumed" (Foley and Lonnroth, 1982, p. 6). Thus, there will always be a subjective element inherent in forecasts which cannot be removed. As Robinson (1982, p. 233) concludes:

> For forecasts to make sense we must assume that the future is determined by past trends that are both discernable and quantifiable. We must assume that there exist certain structural determinants or characteristics of society and social behaviour that can be discovered and measured and that remain relatively constant over time. We must also assume that the observational data on which such analyses are based are neutral and reproducible and that they are not influenced by the preconceptions and beliefs of the analysts.

Energy backcasting was developed in an attempt to overcome some of the limitations of forecasting techniques. Unlike the latter, energy backcasts are explicitly presciptive; they are initially concerned with the desirability of certain energy futures rather than their likelihood. This is an important distinction because a future that is more likely to occur is not necessarily the most desirable, while a more desirable future may exist although it may seem less likely (Robinson, 1982). As a result, users of backcasts maintain that whether a particular future occurs is a political not an analytical question.

Backcasting too, however, is not without problems. As Schrecker (1984, p. 31) has noted, "backcasting implies a considerably more radical departure from incremental, client-centred approaches to public policy." In other words, backcasting represents substantial changes from current modes of policy formulation and involves time horizons that generally exceed those currently considered. The acceptance of energy backcasts for policy formulation, therefore, will meet with resistance because institutions and decision-makers are not used to making choices on such bases (see Hooker and Van Hulst, 1981).

A second limitation of energy backcasts is that the required data are often incomplete or not available. This is particularly so for data on energy end uses and second law efficiencies (energy "matching") (Friends of the Earth, 1983). In many instances, "professional judgment" is required to estimate energy use and efficiencies. Energy backcasts must also project certain variables such as population increase and economic growth and development. Thus, the problems of projecting these attributes is as problematical for energy backcasters as it is for forecasters.

A final limitation of backcasting is the determination of what a "desirable" future is, and who decides it. This issue in turn leads to a number of other questions that have not yet been satisfactorily resolved, namely: How can desirable energy futures be determined in conjunction with other subject and policy fields (e.g. food, industrial strategy, telecommunications)? What type of institutions could provide the possibility of permitting reasonable choices about social futures or of implementing the choices? How can such choices be exercised? (Robinson, 1984).

From this brief review, it can be concluded that both forecasting and backcasting are, implicitly or explicitly, subjective and conditional. The results derived from the use of either methodology are critically dependent on the assumptions and objectives built into the models. Thus, the most important component of these studies is not necessarily the actual numbers that emerge but the assumptions that went into them and the general trends which result. Attention will now be directed towards outlining the major assumptions and/or objectives contained in the four scenarios reviewed above.

3.7 Assumptions and Objectives

One assumption common to all of the scenarios is that Canadian and Albertan energy needs can be met throughout the time period considered in each report. In other words, sufficient energy will be available and no overall shortages are expected. Beyond this assumption, however, substantial differences can be noted, particularly between the ECC and ERCB reports and those submitted by FOE and AEN.

In general, both the ECC and ERCB reports represent energy futures which stress the economic and supply side of energy and are aligned with the *status quo* in terms of institutional arrangements and energy supplies. For example, the ECC maintains that energy policy should be directed towards the achievement of longer term economic growth and stability, based on the underpinnings of the present energy supply industry. The ERCB has also assumed that current government policies would continue to be in effect throughout their forecast period (1986-2010), which in effect endorses the *status quo* with respect to present government initiatives and emphases, as well as the current industrial, regulatory, and distributional structures.

The FOE and AEN studies represent a significant departure in terms of the assumptions and objectives they incorporated. The primary focus was on energy conservation and renewable energy resources. Indeed, FOE assumed that the majority of Canadian energy needs could be met with renewable energy sources by 2025 and that substantial increases in the efficient use of energy are possible and desirable. The AEN assumed that the transition to reliance on renewable energy in Alberta would begin in earnest by the turn of the century. Both studies also assumed that a number of large scale energy projects would not be needed (e.g. Arctic oil, a hydro dam on the Slave River) because of decreases in energy demand and the authors' perception of the deleterious environmental impacts associated with their development. Finally, both reports represent attempts by two environmental organizations to outline what they perceive to be a desirable, and technologically and economically viable, future. Unlike the ECC and ERCB studies, no attempt was made to predict the likelihood of the scenarios they favoured.

The assumptions and objectives outlined above as central to each study do not imply that other considerations were not incorporated. Rather, these assumptions were deemed as the most central and therefore take precedence over the others. The centrality of the assumptions in turn influences the outcome of the forecasts or backcasts. For example, those who believe that increasing the role of the energy industry to provide greater economic benefits is the highest priority will recommend a strategy different from those offered by

groups predominantly concerned with the protection of the environment. Similarily, those who believe that the country or province must be geared towards producing the greatest number of goods and services will differ in their recommendations from those who believe that a major goal should be to conserve resources for future generations. Each of these views therefore contributes to the definition of the problem and the options available to achieve specific goals.

3.8 The Transition From Conventional Oil

The four energy studies reviewed above all acknowledge that supplies of conventional oil, the most important source of energy since the 1940s, are limited and will decline in availability in the medium term. Thus, a transition away from the current mix of energy supplies is inevitable. How the transition is to occur and the strategies proposed to deal with it is where the greatest divergence between the studies can be found.

Two different interpretations of the transition from conventional oil are reflected in the four studies reviewed above. First, the ECC and the ERCB outline scenarios which replace conventional oil with bitumen, coal, natural gas, and eventually with oil and gas from off-shore sources (Arctic and Hibernia). Nuclear power is also projected (by the ECC) to play an important role, while the use of renewable energy resources is expected to be minimal by the year 2000. In fact, the ECC projects that renewable resources (classified as "other sources") will provide only 3% of Canadian primary energy needs in the year 2000 while the ERCB expects their contribution in the same year in Alberta to be less than 1% (excluding hydro electric power generation). Renewable energy resources are not considered viable by the ERCB, for example, because of the low oil price forecasts included in the projection models. However, the proposed oil sands developments and upgraders are not at present considered economic either and will only "come on stream in the latter half of the 1990s commensurate with the return of higher real oil prices and larger price differentials between light and heavy oil" (ERCB, 1986b, p. 8).

Although both the ECC and ERCB considered energy conservation and energy demand, the primary focus was on supplying energy. Indeed, the ECC report was criticized by Brooks (1985, p. 438) for its treatment of energy conservation and demand:

> Energy demand is hardly mentioned, and conservation rates only a single paragraph on existing energy policy. Worse yet, renewable energy sources, which are after all a supply not a demand alternative, are included with demand and conservation, as if to put all the oddballs together at the end.

Energy demand, Brooks argues, should be discussed prior to supply to provide some idea of the purpose of producing the energy in the first place. Conservation is treated as something that occurs after basic supply and demand patterns are set rather than as a fundamental source of change to these patterns themselves (see also Schrecker, 1985).

A second, and vastly different, interpretation of the transition away from conventional oil is provided in the FOE and AEN reports. Specifically, renewable resources will play an increasing and eventually a dominant role in supplying Canadian and Albertan energy requirements. Biomass in both solid and liquid forms is viewed as the most important renewable energy source. Its use is projected to replace oil as a heating and transportation fuel. Modest amounts of solar and wind energy are also expected to contribute to the overall supply pattern. Nuclear power is rejected out of hand by the AEN while the FOE study phases it out by the year 2025. Oil products and natural gas will continue to play an important role, although their use will also be phased out over time. Nevertheless, the AEN projects that oil and gas will continue to supply half of Alberta demand in 2010. The FOE report also projects that oil and gas will supply a substantial proportion of Canadian energy needs until the year 2000. Thereafter, their use will decline markedly; by the year 2025 they will account for less than 15% of total secondary energy demand and will be used mainly as feedstocks for chemicals, fertilizers, plastics, and other nonenergy needs. To meet interim oil demands, two new oil sands plants will be needed in the 1990s.

A fundamental element of both the FOE and AEN studies is the emphasis they place on energy demand and conservation; in both studies, a reduction in demand is expected. The decrease is contingent on the widespread adoption of energy efficient technologies and practices. A reduction in energy demand is vital to the feasibility of relying on renewable

energy resources in the future. Without reduced demands, renewable energy futures would not be possible.

In broad outline then, there are two conceivable strategies for the development of long term energy supplies. The first is a "logical" sequel to the present-day energy supply system as, for example, fuels synthesized from heavy oils and bitumen evolve from today's petrochemical industries, while nuclear power and large scale hydro-electric power projects provide electricity. Limited amounts of renewable energy resources, such as biomass use by the forest industry, are also incorporated. In short, the energy mix projected for the future fits well into the present energy supply system.

The second strategy is based in all essentials on renewable energy and energy conservation and thus represents a departure from the current energy situation and present trends. Biomass use will increase and eventually become the predominant energy source. Nonrenewable energy sources are included but their importance will decrease in the long term.

3.9 Energy Futures and World Views

The development and use of energy, and hence energy policy, have wideranging impacts on all facets of society. As Hooker *et al.* (1981, p. 84) state:

> Energy policy is deeply connected to our social policies, to the style and quality of life we enjoy and hence our culture, and to the ways we think about ourselves as a people. Energy policy is, therefore, a fundamental social policy.

Viewed in this context, the choice of an energy strategy reflects and contributes to the fundamental values and attitudes held by society at large. The delineation of world views into the Dominant Social Paradigm (DSP) and the New Environmental Paradigm (NEP) provides a useful framework within which to assess the energy scenarios reviewed above. The extent to which the scenarios reflect the opposing world views will now be examined.

In general, the forecasts outlined by the ECC and the ERCB are consistent with the major tenets of the DSP. This is particularily evident in terms of their emphasis on economic growth. Indeed, the ECC advocates that energy developments and exports provide a major impetus to the increased well-being of Canada and Canadians. In other words, the production

of energy is treated not just as an activity which must be expanded to meet the projected growth of domestic demand, but as an "engine of growth" itself. The ERCB also favours the growth of energy supply industries although it acknowledges that the emphasis on bitumen production and upgrading will not contribute as much as the traditional supply industry to the economic prosperity of the province because of the large capital investments required, the more expensive production costs involved, and the highly energy intensive nature of the production processes.

A core value of the DSP is that the natural environment is viewed mainly as a resource (Cotgrove, 1982; Dunlap and Van Liere, 1984). Although this value is not explicitly acknowledged in either the ECC or ERCB studies, their lack of reference to environmental impacts implicitly accepts this view. In fact, the word "environment" rarely appears in either of the reports. The ECC deliberately omitted environmental consideration from their analysis, assuming that energy development issues could be considered in the absence of environmental contraints. In neither of the studies are downward adjustments made to future energy consumption levels nor are energy supply options precluded on the basis of environmental considerations. Market forces (i.e. prices) are considered the main criterion for energy decisions. Emanating from this perpective is the advocation of continued reliance on nonrenewable energy resources. Although some forms of renewable energy options are considered, they are not expected to contribute substantially despite arguments that these options are environmentally less detrimental than nonrenewable sources (see for example Brooks, 1984, 1985; Holdren, 1981; Lonnroth *et al.*, 1980; Lovins, 1977; Morrison and Lodwick, 1981; Shrader-Frechette, 1984).

A third major area of congruence between the ECC and ERCB forecasts and the DSP is the continued acceptance of large-scale, centralized energy technologies and delivery systems. Implicit to centralized energy systems is the need to organize and maximize supply and distribution networks, to generate large amounts of capital, to conduct research, and to regulate the entire process (see Lovins, 1977; Shrader-Frechette, 1984). Arguments concerned with economies of scale and efficiency are cited to support these developments.

The futures outlined by the ECC and the ERCB are projections of present-day energy supply and delivery structures. Continued emphasis is given to economic growth and to increasing nonrenewable energy supplies. In short, the scenarios represent incremental changes to the *status quo*. The policies and supply options they support are those favoured by the energy supply industries and governments (Elder, 1984) and are therefore, barring major unforeseen developments, the most likely to materialize.

The energy futures proposed by FOE and the AEN are, in a number of important aspects, closely aligned to the NEP as outlined earlier. The similarities are particularily evident in their emphasis on environmental quality and preservation. In both scenarios, the natural environment is intrinsically valued and some energy supply sources are accepted or rejected on this basis alone (e.g. nuclear power, Arctic oil, damming the Slave River, biomass production in sensitive wilderness areas, biomass harvesting on agricultural land). Emanating from this environmental orientation is the acceptance of the view of the finite nature of natural resources and the need to achieve a sustainable, renewable-energy economy. Both the FOE and the AEN studies accorded these values a central position in their energy scenarios.

According to Brooks (1981, p. 46), "limits to growth of energy would be an early and essential step in any movement towards a conserver society." Indeed, without substantial conservation and efficiency efforts, reliance on renewable resources would not be possible. Both studies demonstrate that the goal of demand reduction is not only possible, but is also technically and economically feasible. The reduction of material "throughput" or resource use is a major attribute of the NEP, to which both studies adhere.

Another important aspect of the NEP, and one reflected in both the FOE and AEN studies, is the contention that decentralized, small-scale development is preferable to centralized, large-scale development. The authors of the FOE report maintain, for example, that their proposals would result in decreased regional dependence on present energy distributional networks, would increase local self-sufficiency, and would promote community involvement in energy decisions. Furthermore, decentralized energy systems would increase the resiliency and diversity of energy supply and delivery systems which would be designed for

maximum effectiveness and adopted to particular locations. The proposed energy systems would also be matched in scale and in geographic distributions to end-use needs. All of these proposals are consistent with the tenets of the NEP.

3.10 Conclusions

The energy futures reviewed can be classified in terms of the degree to which they represent the characteristics of opposing world views. On the basis of the methodologies employed, the major assumptions incorporated in the models, the proposed direction of the transition from conventional oil, and the importance attached to certain values and objectives, the scenarios proposed by the ECC and ERCB are consistent with the major attributes of the DSP (i.e. the *status quo*), while those proposed by the FOE and AEN are more closely aligned with the NEP. It would be innaccurate, however, to state that the forecasts represent the extremes of either world view. Rather, the major *characteristics* of the studies reflect the alternative world views, particularly with regard to the different emphases given to economic growth, environmental impacts, supply and demand, and the centralized/decentralized nature of different energy supply and delivery systems. Thus, the alternative scenarios can be viewed as a debate between two different perceptions: a traditional penchant for economic and technological progress versus a more recent view of the world as finite in resources and limited in potential to support growth.

The ECC and ERCB both outline a future where energy development would move along essentially the same track as has occurred in the past in terms of the energy supply sources used and the industrial and institutional structures needed to promote them. Problems associated with the transition from reliance on conventional oil are not viewed as representing fundamental difficulties. Technological advance and market forces can be safely counted on to make the transition smooth and largely problem-free.

A second interpretation of the transition, encapsulated in the FOE and AEN documents and consistent with the tenets of the NEP, is that the transition represents a time of choice and an opportunity to deal with some of the wider and more fundamental issues

associated with energy development and use: problems with the consequences of growth, with the environment, and with social relations. The implications of energy policy are therefore viewed as superceding exclusively technical and economic considerations.

4. QUESTIONNAIRE DESIGN AND IMPLEMENTATION

4.1 Introduction

A questionnaire survey was conducted in September 1986 to elicit attitudes, values, and perceptions about energy, the environment, and society. Information on the adoption of energy conservation practices was also sought. A random sample of households in Calgary and Edmonton was used to select potential respondents. The survey, along with a covering letter and a postage-paid business reply envelope, was mailed on September 11 and a reminder cards was sent approximately one week later. Of the 1000 questionnaires sent (500 to each city), 403 were returned in a usable condition, representing an effective response rate of 43.2%.[3]

4.2 The Questionnaire

The questionnaire was initially printed on a XEROX 9700 printer using Press-Roman type, then reduced to 75% of its original size, photocopied, and saddle-stitched to form a twelve page booklet. A title page with graphics was specially prepared. A total of 29 questions, which included 103 items, was asked. Space was provided on the back cover for respondents to comment on the topics included in the survey or the questionnaire itself. The questionnaire was divided into four general categories: energy; environmental attitudes; societal values; and socio-economic characteristics.[4] Each will be reviewed below.

Insofar as was possible, question construction, questionnaire design, and survey administration conformed to the recommendations of Dillman's "Total Design Method" (Dillman, 1978).

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[3]68 packages were returned because they failed to reach the respondents.
[4]A copy of the questionnaire is provided in Appendix A.

4.3 Energy

The first half of the questionnaire was concerned with various facets of energy. Question 1 asked respondents whether they felt that the supply of conventional oil would be a major problem, a minor problem, or no problem at all in the next twenty-five years. This question was included following the recommendation made by Dillman (1978) that the first question be topical and interesting to encourage respondents to complete the entire questionnaire. In fact, a total of five questions was included in the questionnaire primarily as "transitional devices". Specifically, the first three questions served to introduce respondents to the questionnaire and the answering format, while Questions 21 and 22 (Environmental concern in Alberta) were used to separate the section concerned with energy from that dealing with environmental attitudes.

4.3.1 Energy Conservation

Four questions were included to elicit information about energy conservation. One asked respondents if they felt the federal and provincial governments should make a greater effort to promote energy conservation (yes or no). The next question (derived from Jackson, 1985) asked what, if anything, good happens when energy is saved. Five precoded answers were provided.

It was deemed both necessary and desirable to find out which, if any, energy conservation practices respondents had adopted. Two questions were included to elicit this information. The first simply asked if efforts had been made to reduce the amount of energy consumed (yes or no). If a "yes" response was given, respondents were asked to list what they had done to conserve energy. To ensure that a broad range of conservation practices was listed, respondents were told that the practices may include things they had done in their household, their place of work, their transportation practices, or their personal habits. Seven blank lines were provided.

4.3.2 Energy Policy Objectives

Energy may be perceived in many different ways. For example, it may be perceived mainly as a commodity like any other in the marketplace, or it may be viewed as an ecological resource that should be extracted and used with care and conserved for future generations. To determine which views of energy respondents deemed important (or not important), they were asked to rate seven objectives that could be incorporated into a strategy for energy development and use: keep costs down; meet essential needs of all members of society; economic security; minimize pollution; energy efficiency; create jobs; and ensure sustainable supplies. A four point scale was provided following each objective: (1) not at all important; (2) not too important; (3) somewhat important; and (4) very important. An ensuing question requested respondents to indicate which objectives they considered to be the most important and second most important. It was deemed necessary to force a ranking of the objectives in this manner because of the possibility that many respondents might rate all or most of the objectives as "very" or "somewhat" important.

4.3.3 Energy Options and Reasons for Choice

Eleven questions to determine respondents' evaluations of, and preferences for, various energy resource options were included. Initially, respondents were asked how each in a list of fifteen energy options could make a contribution to advancing Canada's energy situation. The wording of the question was slightly modified from that used by Jackson (1985) who asked how each option could make a contribution towards *improving* Canada's energy situation. The word "improving" was replaced because some respondents may have felt that the situation does not need improving. A five point scale followed each energy option: (1) poor; (2) fair; (3) good; (4) very good; and (5) excellent.

The next four questions in this section asked for respondents' opinions about the short term development of Canadian energy resources (defined as "the next five years"). First, they were asked which two energy options Canada should emphasize the most. They were then asked to rate the importance of nine precoded reasons (including an "other") in

relation to their choice of most preferred energy option. Each reason was followed by a four point scale: (1) not important; (2) not too important; (3) somewhat important; and (4) very important. A ranking question then requested respondents to indicate which reason they felt was the most important. Finally, respondents were asked to indicate which two energy options they thought Canada should emphasize the least in the short term.

A similar procedure was used with respect to the long term development of Canadian energy resources (defined as "beyond the year 2000"), although two additions were made. First, one extra reason for choice of best energy option was included ("It will lead to a more agreeable society"). It was deemed inappropriate to include this reason in the short term section. Second, a list of six reasons was included to find out why respondents chose a particular option as the *least* desirable in the long run, followed by a question asking for the most important reason. Again, it was judged that the inclusion of this section was unwarranted with respect to the short term energy options.

The questions asking about short and long term energy preferences were slightly modified versions of Jackson's (1985), while the questions concerned with the reasons for choices were substantially modified versions of those initially used by Rodgers (1987). The remainder were developed by the author.

4.4 Environmental Attitudes

A series of twenty one statements was included to elicit attitudes about the environment, economic activity, the quality of life, and science and technology (Table 4.1). The statements used were taken from Jackson (1985) who in turn derived the majority of statements from Dunlap and Van Liere (1978, 1984). Specifically, ten of the twelve statements used by Dunlap and Van Liere (1978) for their "New Environmental Paradigm" scale were included. Of the remaining eleven statements, nine were from Dunlap and Van Liere's (1984) "Dominant Social Paradigm" scale. The remaining two were constructed by Jackson (1985) and this author (Table 4.1).

TABLE 4.1
ENVIRONMENTAL ATTITUDE STATEMENTS

	Statement	Original Source	Modification
1.	In the long run, there are no limits to the extent to which we can raise our standard of living	Jackson: 1985	No
2.	The earth is like a spaceship with only limited room and resources*	Dunlap and Van Liere: 1978	No
3.	There are no limits to growth beyond which our industrialized society cannot expand*	Dunlap and Van Liere: 1978	No
4.	We can continue to raise our standard of living through the application of science and technology*	Dunlap and Van Liere: 1984	Yes
5.	Humans must live in harmony with nature in order to survive*	Dunlap and Van Liere: 1978	No
6.	Economic growth improves the quality of life for all Canadians*	Dunlap and Van Liere: 1984	Yes
7.	The balance of nature is very delicate and easily upset*	Dunlap and Van Liere: 1978	No
8.	Rapid economic growth often creates more problems than benefits*	Dunlap and Van Liere: 1984	No
9.	Mankind is severely abusing the environment*	Dunlap and Van Liere: 1978	No
10.	We are approaching the limit to the number of people the earth can support*	Dunlap and Van Liere: 1978	No
11.	Most problems can be solved by applying more and better technology	Dunlap and Van Liere: 1984	No
12.	Humans need not adapt to the environment because they can remake it to suit their needs*	Dunlap and Van Liere: 1978	No
13.	Mankind was created to rule over the rest of nature	Dunlap and Van Liere: 1978	No
14.	We cannot keep counting on science and technology to solve mankind's problems*	Dunlap and Van Liere: 1984	No

15.	More emphasis should be placed on teaching children about nature than on teaching them about science and technology*	Original	
16.	When humans interfere with nature it often produces disastrous consequences*	Dunlap and Van Liere: 1978	No
17.	Science and technology often do as much harm as good*	Dunlap and Van Liere: 1984	Yes
18.	Canadians are going to have to reduce their consumption of material goods over the next few years*	Dunlap and Van Liere: 1984	Yes
19.	Humans have the right to modify the environment to suit their needs	Dunlap and Van Liere: 1978	No
20.	The positive benefits of economic growth far outweigh any consequences*	Dunlap and Van Liere: 1984	No
21.	In general, the Canadian people would be better off if the nation's economy stopped growing*	Dunlap and Van Liere: 1984	Yes

* Statement scores reversed during analysis.

A number of modifications to Dunlap and Van Liere's statements were made by Jackson, and with one exception, were replicated in this study. Statement 18 originally posited "Canadians are going to have to *drastically* reduce their consumption of material goods over the next few years." The word "drastically" was removed.

A five point Likert-type scale followed each statement to measure variations in the public's responses. For each statement in the scale respondents were asked to indicate the extent to which they agreed or disagreed. For the purposes of aggregation, the scores assigned to pro-environmentally oriented statements were reversed so that a low score uniformly represented this perspective (Table 4.1).

TABLE 4.2
SOCIETAL VALUES SCALE[1]

1. A society in which there is (A) a continually growing economy, or (B) one in which there is no growth?*
2. A society in which (A) production is selective (e.g., towards products which use little energy), or one which (B) aims to satisfy the market for consumer goods?
3. An economy geared to (A) overcoming the limits to growth (e.g., from exhaustion of some raw materials), or one which (B) accepts that there are limits to growth?*
4. A society in which (A) individuals live their lives in a community, or one in which (B) individuals are free to go their own way?
5. A society with (A) strong law and order, or one which (B) attaches relatively less importance to law and order?*
6. A society in which (A) individuals have considerable say in how things get decided at their workplace, or one in which (B) decisions (after consultation) are left to management?
7. A society which (A) emphasizes work which is humanly satisfying, or one where (B) work is controlled mainly by the needs of industry?
8. A society which (A) emphasizes rewards for talent and achievement, or one where (B) the emphasis is on other criteria (such as need)?*
9. A society which (A) emphasizes the social and collective provision of welfare, or one where (B) individuals are encouraged to look after themselves?
10. A society which (A) has strong emphasis on community and belonging, or (B) one where the emphasis is on individualism?
11. A society which (A) emphasizes the participation of individuals in major government decisions, or (B) leaves the final decisions to the judgement of the elected officials?
12. A society which (A) recognizes differentials related to skill, education, and achievement, or one which (B) emphasizes similar rewards and incomes for everybody?

[1] Source: Cotgrove (1982, p. 131).
* Statement scores reversed during analysis.

4.5 Societal Values

One question, consisting of twelve items, comprised this section. All twelve items were taken from Cotgrove (1982) who used the statements to construct a "societal values" scale (Table 4.2). To introduce this section, the following question was asked: "Modern

society is based, in part, on many different ideas and opinions which you may or may not agree with. How would you describe the *ideal* type of society, from your point of view?" The question wording was substantially modified from that used by Cotgrove (1982, p. 131).

A list of twelve dichotomies that could be used to characterize a possible ideal society was included, each followed by a seven point scale. An example of an answered statement was provided to demonstrate the answering format.

Some minor changes were made to three statements. Specifically, in statements 4, 6, and 9 words denoting gender were altered so that they were not gender specific. As was the case with the attitudes statements, the scores of some statements were reversed during analysis (Table 4.2). Thus, a low score consistently represented an anti-economic values orientation.

4.6 Socio-Economic Characteristics

The final section of the questionnaire requested information on the socio-economic charateristics of the sample, namely their sex, age, level of education, major subject studied at university (if applicable), and income. Following the advice of Dillman (1978) this section was placed at the end of the questionnaire. Respondents were assured that this information was needed for classification purposes only, and would be treated confidentially.

4.7 Survey Administration

Two series of pretests were conducted prior to finalizing the questionnaire. Initially, a draft was given to individuals from the university community and the Edmonton Energy Conservation Centre. On the basis of this pretest, numerous changes were made with respect to the wording of some questions, changing the format of others, and deleting some questions entirely.

A second pretest was conducted approximately six weeks prior to the final mailout. One hundred randomly selected households in Edmonton were mailed a booklet-type questionnaire, a covering letter, and a business reply envelope. On the basis of the returns, two significant changes were made. First, a section devoted to two hypothetical energy

development scenarios for Alberta was dropped because of the complexity of the questions and the length of each scenario (approximately one-half page each). Second, the two pages thus created were used to elicit detailed information about respondents' preferences for energy options, as outlined earlier in this chapter.

Substantial changes were also made to the form and content of the covering letter. With respect to content, the entire first paragraph was rewritten, emphasizing the uncertain nature of energy development in Alberta and how the major foci have shifted during the past fifteen years. More emphasis was also given to stressing the widespread impact energy has on all Albertans. Some other minor wording changes were also made.

The form of the letter was also modified. First, the text was typed on an IBM Selectric typewriter using letter-gothic type. It was felt that this would present a less impersonal format to the potential respondents compared to the computer-produced type used initially. Second, a specially prepared letter containing graphics similar to those produced for the questionnnaire cover was designed.[5] In this way, it was hoped a more "professional" appearance to the whole questionniare package could be achieved.

4.8 Sample Methodology

The study was conducted in Calgary and Edmonton. A random sample of 500 households in each city was obtained from the Statistics Branch of the Alberta Treasury Board. Once selected, each household was mailed a copy of the questionnaire, a covering letter, and a postage-paid business reply envelope. All packages were mailed on September 11, 1986. Approximately one week later, a reminder card was sent.[6] Three weeks after the initial mailout as many households as possible were contacted by telephone to encourage potential respondents to complete the questionnaire if they had not already done so. For those who did not complete the survey, who lost their original copy, and who indicated a willingness to comply, a second package was mailed. A new covering letter[7] was the only

[5] A copy of the covering letter is provided in Appendix B.
[6] A copy of the reminder card is provided in Appendix B.
[7] A copy of the second covering letter is provided in Appendix B.

difference between the first and second packages. In total, 155 questionnaires were sent in the second phase.

4.9 Response Rates

A total of 68 packages failed to reach respondents and were returned as undeliverable. Thus, the effective sample was 932 respondents. The response to the initial mailing and subsequent reminder card amounted to 335 or 33.5% of the original mailing, and 35.9% of the effective sample. Returns to the second phase amounted to 68 or 43.9% of the 155 packages mailed. In all, 403 questionnaires were returned, representing a response rate of 40.3% of the original mailout and 43.3% of the effective sample. Of the 403 questionnaires, 229 (56.8%) were from residents of Edmonton while the remaining 174 returns (43.2%) came from Calgarians.

Analysis was conducted to determine the legitimacy of combining the returns from both phases into a single sample. No significant differences emerged in terms of socio-economic characteristics or responses to the main dependent variables. Similarily, no differences were found between the returns from Calgary and Edmonton.

4.10 Socio-Economic Frequencies

To determine the representativeness of the sample, the socio-economic characteristics of the respondents were compared to the socio-economic characteristics of residents in Edmonton and Calgary over fifteen years of age as reported in the Census of Canada (1981). As shown in Table 4.3, the socio-economic characteristics of those responding to the survey did not mirror those reported in the census. Males were overrepresented. With respect to age, the 15-25 years-old category was underrepresented while the 26-45 age categories were overrepresented. In the covering letter, adult members of the households were specifically asked to participate, thereby reducing the possiblity that younger members would complete the survey. This may also help to account for the underrepresentation of those with only primary or secondary education (27.3% of the sample compared to 49.7% in the census).

Discrepancies between the categories of total household income were also evident. Specifically, households with incomes of more than $30,000 were overrepresented while those in the two lower income categories were underrepresented.

Despite the differences between the socio-economic characteristics of the sample and those of the census, a cross-section of the Edmonton and Calgary population was represented. In all cases the number of respondents in each category was sufficient to allow for statistical analysis with the other variables. Therefore, potential differences based on socio-economic characteristics could be ascertained. For all statistical tests used in this study, the 0.05 level was used to determine the statistical significance of associations between variables.

TABLE 4.3
SOCIO-ECONOMIC CHARACTERISTICS OF RESIDENTS OF EDMONTON AND CALGARY[1] AND THOSE OF THE SURVEY RESPONDENTS

Socio-Economic Variables		Census N	Census %	Survey N	Survey %	Percentage Difference
Sex:	Male	449,035	50.5	258	64.5	+14.0
	Female	440,630	49.5	142	35.5	-14.0
	Total	889,665	100.0	400	100.0	
Age[2]:	15-25	262,485	29.5	40	10.0	-19.5
	26-35	238,850	26.8	128	32.0	+ 5.2
	36-45	129,740	14.6	95	23.7	+ 9.1
	46-55	106,205	11.9	54	13.5	+ 1.6
	56-65	77,125	8.7	48	12.0	+ 3.3
	>65	75,260	8.5	35	8.7	+ 0.2
	Total	889,665	100.0	400	100.0	
Education:	Up to secondary	437,415	49.7	108	27.3	-20.4
	Post-secondary to some university	239,085	27.2	169	42.8	+15.6
	At least a university graduate	203,315	23.1	118	29.9	+ 6.8
	Total	879,815	100.0	395	100.0	
Income[3]:	Less than $15,000	111,340	25.2	32	8.4	-16.8
	$15,000-$30,000	145,275	32.8	100	26.2	- 6.6
	> $30,000	186,025	42.0	249	65.4	+23.4
	Total	442,640	100.0	381	100.0	

[1] Population 15 years of age and older.
[2] Categories between the census and survey differed slightly.
[3] Total household income.
Source: Census Canada, 1981.

5. ENERGY PREFERENCES

5.1 Introduction

A substantial portion of the questionnaire was devoted to determining respondents' preferences for energy options. A list of fifteen energy options was provided and respondents were asked to evaluate the potential of each to make a major contribution to advancing Canada's energy situation. A five point scale was provided ranging from (1) poor to (5) excellent.

A diverse set of energy options was included for consideration. Both supply and demand options were represented. Coal for electricity generation and increasing the development of offshore oil sources were examples of the former category, while encouraging energy conservation practices amongst industrial users and members of the public were included in the latter category. The list of options can also be viewed in terms of a renewable-nonrenewable taxonomy. Four options comprised the renewable category (e.g. solar, hydro-electricity) and six made up the nonrenewable category (e.g. natural gas, oil from the oil sands). Optimally, it would have been desirable to have included a more detailed list of options which would allow respondents to distinguish more clearly among various alternatives within each category (e.g. small-scale vs. large-scale hydro; active vs. passive solar energy). However, the inclusion of all possible options would have made the list unduly long and difficult for the respondents to evaluate.

The mean scores obtained for each energy option are presented in Table 5.1. Encouraging energy efficient practices amongst industrial users and individual members of the public were ranked first and second respectively. The importance of energy efficiency or conservation was further confirmed in that four of the five highest rated options fell into this category. Natural gas, rated third, was the exception. Only four options had mean scores below the theoretical mean (3.00): coal for electricity generation; nuclear power; wood for conversion to methanol; and wood for home heating.

TABLE 5.1
ENERGY OPTIONS: MEAN SCORES

Options	Mean Scores	Rank
Conservation by industry	4.14	1
Conservation by the public	3.92	2
Natural gas	3.91	3
Building standards	3.78	4
Product standards	3.74	5
Solar energy	3.68	6
Hydro	3.67	7
Tar sands	3.61	8
Conventional oil	3.56	9
Wind energy	3.15	10
Off-shore oil	3.13	11
Coal	2.66	12
Nuclear	2.29	13
Wood for gas	2.21	14
Wood for heat	1.98	15

The above list of options was used as a basis to determine which options the public preferred most and least in the short and long term, and the reasons for their choices. However, prior to presenting these results, it is necessary to discuss the procedure used for aggregating the energy options.

Two categories of energy preferences were formed. First, a six-part classification was made and will be referred to as the "general categories": 1) fossil fuels (consisting of coal, conventional oil, offshore oil, tarsands, and natural gas); 2) conservation (conservation by industry, conservation by the public, energy efficiency standards for builings, and standards for consumer products); 3) solar and wind power; 4) nuclear power; 5) hydro electricity; and 6) biomass (wood for home heating and conversion to methanol). The rationale for this taxonomy was to combine the options which logically formed a single group (e.g. the fossil fuels) and to present the results of unique options in an unaggregated form.

The second classification scheme, which will be referred to as the "major categories", consisted of three groups, namely renewable, nonrenewable, and conservation. The renewable energy category consisted of solar and wind energy, hydro electricity, and the two biomass options. Nuclear power and the fossil fuels made up the nonrenewable category, while the conservation category was the same as presented above.

Although the above categories are somewhat analogous to Lovins's (1977) hard path/soft path dichotomy, the use of his terms will be avoided because of the ambiguity of classifying some of the options as presented in the questionnaire. Particularly problematical was hydro-electric power which could fit into either the hard or soft categories depending on the scale and impact of each individual project. The damming of the Slave River, for example, would be considered a "hard path" option by most proponents of the soft path, even though hydro is a renewable resource. The large scale of the project, the necessity of centralized control and reliance on experts, and potentially adverse environmental consequences would be cited to support this view. In other words, numerous factors besides the renewability of an energy resource must be considered prior to labelling it soft or hard. Respondents to the questionnaire were not asked, for example, to distinguish between large scale (hard path) and small scale (soft path) hydro power; therefore to classify it in one category or the other would involve a leap of faith this author is not prepared to take.

5.2 Short Term Energy Options

5.2.1 Preferences

Respondents were asked which two of the energy options Canada should emphasize the most in the short run, defined as the "next five years". Table 5.2 presents the results for the most preferred option and the second most preferred option.

Fossil fuels were cited by over half of the respondents (55.5%) as options Canada should emphasize the most. Within this category, conventional oil was rated highest (29.0%) followed by oil from the tar sands (10.1%), natural gas (8.6%), coal and offshore oil (4.0% each). Approximately one-fifth of the respondents chose one of the four conservation options, with conservation by industry receiving the most support (8.6%). Solar and wind energy were highly rated by about 15% of the sample, while hydro-electric power, nuclear power, and biomass all received support from less than 10% of the sample.

TABLE 5.2
SHORT TERM ENERGY PREFERENCES

Option	Most Preferred N	Most Preferred %	Second Most Preferred N	Second Most Preferred %
A. General Categories				
Fossil fuels	221	55.5	187	47.1
Conservation	76	19.1	98	24.7
Solar/wind	63	15.8	72	18.1
Hydro	30	7.5	22	5.5
Nuclear	5	1.3	13	3.3
Biomass	3	0.8	5	1.3
B. Major Categories				
Nonrenewable	226	56.9	200	50.4
Renewable	96	24.0	99	24.9
Conservation	76	19.1	98	24.7
Total	398	100.0	397	100.0

Although the rank order of the second best short term energy preferences was the same as those most preferred, some differences were found. Both conservation and solar and wind power had higher frequencies of support while support for the fossil fuels declined.

In terms of the major categories, nonrenewable energy options were favoured by about 57% of the respondents (Table 5.2). Indeed, more than twice as many respondents preferred these options compared to the renewables. This was also the case for the second most preferred option.

To determine if respondents consistently preferred options within each of the major energy categories, crosstabulation analysis was undertaken between the most and second most preferred options (Table 5.3). More than two-thirds (68.0%) of respondents listing one of the nonrenewable options as their most preferred listed an option in this category as their second choice. Those preferring a renewable option as their most preferred were more divided as to their second choice. Specifically, 38.9% preferred another renewable resource while just under 30.0% preferred a conservation option. The remainder preferred a nonrenewable option. Finally, the majority of respondents most preferring a conservation option also preferred one of these options as their second choice (59.2%).

TABLE 5.3
CROSSTABULATION: MOST PREFERRED ENERGY OPTION AND SECOND MOST PREFERRED ENERGY OPTION: SHORT TERM

Second Most Preferred	Most Preferred		
	Nonrenewable %	Renewable %	Conservation %
Nonrenewable	68.0	31.6	21.1
Renewable	20.9	38.9	19.7
Conservation	11.1	29.5	59.2
Total (n)	(225)	(95)	(76)

Chi-square = 97.58; d.f. 4; $p < 0.0001$

5.2.2 Reasons for Choice

Based on the energy option rated as the best in the short term, respondents were asked to evaluate eight reasons in terms of each one's effect on their choice. Respondents were also asked to indicate which reason they felt was the most important. The initial results are presented in Table 5.4.

TABLE 5.4
SHORT TERM ENERGY PREFERENCES: REASONS FOR CHOICE

Reasons	Mean Scores		Most Important Reason		
	Mean	Rank	N	%	Rank
Energy for the longest time	3.23	1	75	19.5	1
Most economically efficient	3.19	2	62	16.1	2
More economic growth	3.05	3	43	11.2	6
Fewer environmental effects	3.00	4	61	15.8	3
Too much energy wasted	2.95	5	54	14.0	5
Will create more jobs	2.94	6	57	14.8	4
Diversify energy resource base	2.65	7	15	3.9	8
No other alternatives	2.31	8	28	4.7	7
Total	-	-	385	100.0	-

The mean scores for all reasons were similar; the range between the highest ("It will provide the energy we need for the longest time") and the lowest ("There are no other alternatives") was less than 1.0. Rated second and third were economic reasons relating to efficiency and growth. Having fewer environmental impacts and the perception that too much energy is currently being wasted were ranked fourth and fifth, followed by job creation

and diversifying the energy resource base.

Energy security and economic efficiency continued to be ranked first and second when measured in terms of the "most important reason" variable. However, environmental effects now ranked third while economic growth was sixth. Nevertheless, the percentage difference between the first and sixth most frequently mentioned reasons was less than 5.0%. Diversifying the energy resource base and "no other alternatives" remained the two lowest rated reasons.

5.2.3 Energy Preferences and Reasons for Choice

Although the data presented above provide some insight into the reasons respondents had for choosing the best energy option in the short term, it is important to examine the support given to the different reasons by those preferring specific energy options. Analysis of variance was conducted between the most preferred energy option variable and each reason listed in this section of the questionnaire. The major energy categories were used for this analysis.

Respondents who preferred nonrenewable resources placed significantly more emphasis on the two economic reasons of job creation and economic growth. Having fewer environmental effects, diversifying the energy resource base, and long term energy security were significantly more important to proponents of renewable options, while the reason "Too much energy is now wasted" was rated the highest by those respondents most preferring conservation.

Economic efficiency and security reasons were rated between "somewhat" and "very" important by most respondents regardless of their short term energy preferences. Although statistically significant differences were found between respondents' support for the security reason, the results indicate that general agreement was apparent. The reasons "no alternative" and "economic efficiency" were not significantly associated with the respondents' short term energy preferences.

These results were confirmed when the major energy categories were crosstabulated against the "most important reason" variable. As shown in Table 5.5, respondents who most preferred nonrenewable energy resources more frequently cited the reasons of job creation, economic efficiency, and economic growth as the most important. In contrast, over a third of the proponents of renewable energy rated fewer impacts on the environment as the most important reason. The latter reason and the perceived wastage of energy were deemed important by those respondents favouring conservation. Providing energy for the longest time (i.e. security) was very important to all respondents, but particularly to advocates of renewable energy resources.

TABLE 5.5
SHORT TERM ENERGY PREFERENCES AND MOST IMPORTANCE REASON FOR CHOICE

Reason	Energy Preferences		
	Nonrenewable %	Renewable %	Conservation %
No other alternatives	7.3	1.1	1.4
Create more jobs	21.0	8.8	4.1
Most economically efficient	21.5	9.9	8.2
Fewer environmental effects	7.3	37.4	15.1
More economic growth	15.5	5.5	2.7
Too much energy wasted	4.1	6.6	53.4
Diversify energy resource base	3.7	4.4	4.1
Energy for the longest time	19.6	26.4	11.0
Total (n)	(219)	(91)	(73)

Chi-square = 181.85; d.f. = 14; $p < 0.0001$

5.3 Long Term Energy Options

5.3.1 Preferences

Long term energy preferences were measured in a similar manner to those of the short term. Respondents were asked which energy option Canada should emphasize the most. Solar and wind energy were rated the highest by approximately 38% of the respondents (32.2% solar; 5.6% wind; Table 5.6). The fossil fuels were rated second. Within this category, tar

sands had the most support (13.2%), followed by offshore oil (7.1%), conventional oil (6.8%), natural gas (4.8%), and coal (3.0%). Hydro electric power ranked third. Energy conservation, nuclear power, and biomass all received less than 10% suppport. Because biomass was chosen as the most preferred option by only 0.3% of the sample, it was excluded from the analysis.

TABLE 5.6
LONG TERM ENERGY PREFERENCES

Options	Most Preferred N	Most Preferred %	Second Most Preferred N	Second Most Preferred %
A. General Categories				
Solar/wind	149	37.7	106	27.2
Fossil fuels	138	34.9	143	36.7
Hydro	48	12.2	34	8.7
Conservation	31	7.8	67	17.2
Nuclear	28	7.1	37	9.5
Biomass	1	0.3	3	0.7
B. Major Categories				
Renewable	198	50.1	143	36.7
Nonrenewable	166	42.0	180	46.1
Conservation	31	7.9	67	17.2
Total	395	100.0	390	100.0

The relative order of the options was altered with respect to the second most preferred options (Table 5.6). Most notable was the decrease in support for solar and wind energy by approximately 10 percentage points, and the increase in support for energy conservation by 10 percentage points. Fossil fuels received approximately the same support as the second most preferred option. Hydro electric power, nuclear power, and biomass all received less than 10% support as the second most preferred options.

Results from crosstabulation analysis between respondents' most and second most preferred options are presented in Table 5.7. The results are similar to those presented with respect to the short term. The majority of respondents who most preferred a nonrenewable resource also listed a nonrenewable resource as their second choice (62.0%). A similar percentage of respondents most preferring conservation (61.3%) as the best in the long term also listed a conservation option as their second choice. Less than half (46.6%) of the

respondents who cited a renewable resource as their most preferred option followed suit for their second choice.

TABLE 5.7
CROSSTABULATION: MOST PREFERRRED ENERGY OPTION AND SECOND MOST PREFERRED ENERGY OPTION: LONG TERM

Second Most Preferred	Most Preferred		
	Nonrenewable %	Renewable %	Conservation %
Nonrenewable	62.0	37.3	16.1
Renewable	27.7	46.6	22.6
Conservation	10.2	16.1	61.3
Total (n)	(166)	(193)	(31)

Chi-square = 68.85; d.f. = 4; $p < 0.0001$

Overall, these data suggest that respondents' most and second most preferred options were consistent, particularly between those who preferred nonrenewable and conservation options. As was the case with the short term, the same degree of consistency was not evident amongst respondents most preferring renewable options. Indeed, over a third of these respondents listed a nonrenewable resource as their second most preferred option. Nevertheless, the majority still preferred a renewable or conservation option rather than a nonrenewable one.

5.3.2 Reasons for Choice

Respondents were asked to evaluate nine reasons in relation to the energy option they preferred most in the long run. A question asking for the most important reason was also included.

Providing energy for the longest time (i.e. security) was rated as the most important reason both in terms of mean scores and "most important reason". Indeed, just over one third of the sample considered it as the most important (Table 5.8). Having fewer environmental effects and being the most economically efficient were the only other reasons to have mean scores greater than 3.0 and more than 10% of the respondents citing them as the most important.

In contrast to the short term reasons, where six reasons received substantial support, three reasons accounted for 69.1% of all responses with respect to long term energy preferences. As a result, the reasons of security, the environment, and economic efficiency can be considered the most salient.

TABLE 5.8
LONG TERM ENERGY PREFERENCES: REASONS FOR CHOICE

Reasons	Mean Scores		Most Important Reason		
	Mean	Rank	N	%	Rank
Energy for the longest time	3.66	1	132	33.5	1
Fewer environmental effects	3.26	2	83	21.1	2
Most economically efficient	3.19	3	57	14.5	3
Diversify energy resource base	2.99	4	26	6.6	5
Too much energy wasted	2.96	5	25	6.3	6
More economic growth	2.94	6	22	5.6	7
No other alternatives	2.93	7	14	3.5	8
Will create more jobs	2.75	8	31	7.9	4
More agreeable society	2.64	9	4	1.0	9
Total	-	-	394	100.0	-

5.3.3 Energy Preferences and Reasons for Choice

Significant differences were found in the results of an analysis of variance test between the most preferred energy option and each reason for choice variable. The major energy categories were used for this analysis.

Two reasons, both rated highly by all respondents, were not significantly associated with long term energy preferences. Specifically, the reasons of economic efficiency and long term energy security were rated between "somewhat" and "very" important regardless of the respondents' energy preferences. Long term security in particular was highly rated.

As was the case for the short term, respondents most preferring nonrenewable resources placed more emphasis on job creation and economic growth. Proponents of renewable energy felt that the reasons related to the environment, diversifying the energy resource base, and social impacts were very important. Respondents who favoured conservation had the highest mean score on the "energy wasted" reason, although they too felt that environmental effects and social impacts were important.

The results of crosstabulation analysis between the major energy categories and the "most important reason" variable confirm those presented above. The reason "It will lead to a more agreeable society" was excluded from the analysis because of the low number of respondents citing it (less than 4.0%).

As shown in Table 5.9, ensuring that energy is available for the longest time was cited as the most important reason by about a third of the respondents in each energy category. Economic efficiency was also important to a substantial proportion of respondents but particularly so for the advocates of conservation (25.8%). The latter group also rated the reasons of wasteful energy practices (22.6%) and fewer environmental impacts (12.9%) as the most important. Both job creation (15.7%) and economic growth (9.0%) were the most important for those preferring nonrenewable options, while over a third of the respondents (34.2%) preferring renewable options felt that having fewer environmental impacts was the most important reason for their choice.

TABLE 5.9
LONG TERM ENERGY PREFERENCES AND MOST IMPORTANCE REASON FOR CHOICE

Reason[1]	Energy Preferences Nonrenewable %	Renewable %	Conservation %
No other alternative	4.8	2.0	6.5
Create more jobs	15.7	2.6	0.0
Most economically efficient	15.7	11.7	25.8
Fewer environmental effects	7.2	34.2	12.9
More economic growth	9.0	3.6	0.0
Too much energy wasted	3.6	5.6	22.6
Diversify energy resource base	6.0	7.7	3.2
Energy for the longest time	37.3	31.3	29.0
Total (n)	(165)	(193)	(31)

Chi-square = 86.41; d.f. = 14; $p < 0.0001$
[1] Excludes "more agreeable society".

Based on the results presented above and those concerned with short term preferences, a "reasons profile" of respondents preferring different categories of energy options can be formulated. Creating jobs and promoting economic growth were reasons associated predominantly with respondents most preferring nonrenewable options. Having fewer

environmental impacts was important to respondents preferring renewable resources (mainly solar and wind energy), while the perceived wastage of energy and environmental impacts were reasons associated with advocates of energy conservation. Long term energy security was important to a substantial percentage of all respondents regardless of their energy preferences. The same was true for the reason relating to economic efficiency, although to a lesser degree.

5.4 Least Preferred Energy Options

5.4.1 Preferences

In both the short and long term sections of the questionnaire, respondents were asked which energy options they felt Canada should emphasize the least. Although respondents were requested to indicate which energy options they preferred least and second least, only the least preferred options will be examined in this section to facilitate comparisons between the short and long term preferences.

As illustrated in Table 5.10, nuclear power was the least preferred option of over a third of the respondents in both temporal categories. Over a quarter of the respondents indicated that energy from biomass should not be emphasized in either the short (26.5%) or long term (25.2%). The fossil fuels, particularly coal (approximately 15.0% in each temporal category), were options least preferred by 22.0% of the sample in the short term, and 31.8% in the long term. Collectively, these three categories accounted for 86.7% of the responses in the short term and 91.0% in the long term. Solar and wind energy, conservation, and hydro electric power were generally not evaluated unfavourably. In fact, no respondents rated hydro as a least preferred long run option.

In terms of the major energy categories, nonrenewable resources were the least preferred options by the majority of the respondents in both temporal periods (60.2% and 65.8% respectively). Renewable resources (mainly biomass) were not favoured by 38.5% of the respondents in the short term and by 32.1% in the long term. A small percentage of the

sample rated energy conservation as a least preferred option (1.3% and 2.1% in the long and short term respectively).

TABLE 5.10
LEAST PREFERRED ENERGY OPTIONS: SHORT AND LONG TERM

Options	Short Term			Long Term		
	N	%	Rank	N	%	Rank
A. General Categories						
Nuclear	144	38.2	1	128	34.0	1
Biomass	100	26.5	2	95	25.2	3
Fossil Fuels	83	22.0	3	120	31.8	2
Solar/wind	43	11.4	4	26	6.9	4
Conservation	5	1.3	5	8	2.1	5
Hydro	2	0.5	6	0	0	6
B. Major Categories						
Nonrenewable	277	60.2	1	248	65.8	1
Renewable	145	38.5	2	121	32.1	2
Conservation	5	1.3	3	8	2.1	3
Total	377	100.0	-	377	100.0	-

5.4.2 Reasons for Choice

Respondents were requested to evaluate five reasons for their choice of least preferred long run option (Table 5.11). Three reasons were found to predominate in terms of being the most important: having more serious environmental effects (46.2%); providing less security (22.7%); and being economically unrealistic (18.8%). Collectively, these reasons accounted for 87.7% of all responses. Potential losses of jobs and leading to a less agreeable society

TABLE 5.11
LEAST PREFERRED LONG TERM ENERGY OPTIONS: REASONS FOR CHOICE

Reasons	Mean Scores		Most Important Reason		
	Mean	Rank	N	%	Rank
Most serious environmental effects	3.26	1	165	46.2	1
No security	2.84	2	81	22.7	2
Economically unrealistic	2.81	3	67	18.8	3
Less agreeable society	2.66	4	14	3.9	5
Too many jobs lost	2.10	5	30	8.4	4
Total	-	-	357	100.0	-

were deemed as the most important reasons by 8.4% and 3.9% of respondents respectively.

5.4.3 Least Preferred Energy Option and Reasons for Choice

An analysis of variance was conducted between respondents' least preferred long term energy preferences and each reason for choice variable. The general categories were used for this and subsequent analysis in this section because of the substantial number of respondents citing biomass and nuclear power as options they least preferred. Conservation was combined with solar and wind energy because of the low number of respondents opposed to the former option (2.1%). No respondents cited hydro as a least preferred option.

The reason "Too many jobs would be lost" was not significantly associated with respondents' least preferred energy options. Being economically unrealistic and not providing as much security were important to respondents indicating that solar and wind energy, and biomass should not be emphasized in the long term. Having more serious environmental consequences was very highly rated by respondents citing nuclear power as an option not to be emphasized, as was the reason "leading to a less agreeable society".

Crosstabulation analysis was conducted between respondents' least preferred long term option and their most important reason for this choice (Table 5.12). The "reason profile" was the most similar between respondents citing the fossil fuels and biomass as options not to be emphasized. Being economically unrealistic (fossil fuels, 19.1%; biomass, 28.4%), having more serious environmental effects (fossil fuels, 43.5%; biomass, 34.7%), and not providing as much security (fossil fuels, 23.5%; biomass, 29.5%) were all listed by substantial numbers of respondents in each energy category. One reason predominated for those opposed to nuclear power; the potentially harmful environmental effects reason was cited by over two-thirds of the respondents in this category. For respondents citing solar and wind energy (mainly wind energy), two reasons predominated: being economically unrealistic (32.3%); and providing less security (45.2%).

It can be concluded that, with respect to respondents' least preferred energy option, no one reason predominated. Although the issue of long term security was cited by over 10%

of the respondents in each energy category, substantial differences between respondents in the different categories were found (e.g. solar/wind, 45.2%; nuclear 10.4%). Having potentially serious environmental consequences was important to respondents citing the fossil fuels, nuclear power, and biomass, while being economically unrealistic was important to those listing fossil fuels, solar and wind energy, and biomass. Leading to a less agreeable society was deemed important by less than 7% of respondents in each energy category.

TABLE 5.12
LEAST PREFERRED LONG TERM ENERGY OPTIONS AND MOST IMPORTANT REASONS FOR CHOICE

Reason	Fossil Fuels	Solar/ Wind/ Conservation	Nuclear	Biomass
	%	%	%	%
Economically unrealistic	19.1	32.3	7.0	28.4
Too many jobs lost	9.6	12.9	8.7	5.3
More environmental effects	43.5	3.2	69.6	34 7
No security	23.5	45.2	10.4	29.5
Less agreeable society	4.3	6.5	4.3	2.1
Total (n)	(115)	(31)	(115)	(95)

Chi-square = 65.07; d.f. = 12; $p < 0.0001$

5.5 Most Preferred and Least Preferred Energy Options

Crosstabulation analysis was conducted to determine if an association between respondents' most preferred short and long term energy options and their least preferred options for the corresponding time periods was evident. As shown in Table 5.13, statistically significant relationships were found. Indeed, the general pattern of results was similar in both cases.

The vast majority of respondents who preferred renewable resources considered that nonrenewable resources should be emphasized the least in both the short and long term (74.4% and 80.4% respectively). In the short term, for example, these respondents felt that the fossil fuels (29.1%) and nuclear power (45.3%) should be emphasized the least. Comparable figures for the long term were 38.1% and 42.3% for fossil fuels and nuclear power respectively.

Similar results were found for those favouring energy conservation measures; over 60% felt that nonrenewable resources should be emphasised the least in the short term (27.8%, fossil fuels; 33.3% nuclear) while 70.4% concurred in the long term (fossil fuels, 29.6%; nuclear 40.7%). For both temporal periods, proponents of nonrenewable energy were split over which energy options they felt should be emphasized the least. Just over half (54.2%) cited renewable options in the short term (solar/wind, 18.5%; biomass, 27.3%), and slightly under half (47.2%) cited renewable options in the long term (solar/wind, 15.1%; biomass, 37.7%).

TABLE 5.13
CROSSTABULATION: MOST PREFERRED ENERGY OPTIONS AND LEAST PREFERRED ENERGY OPTIONS: SHORT AND LONG TERM

Least Preferred	Most Preferred: Nonrenewable %	Renewable %	Conservation %
Short Term[1]			
Fossil fuels	17.1	29.2	27.8
Solar/wind/conservation	18.5	4.7	8.3
Nuclear	37.0	45.3	33.3
Biomass	27.3	20.9	30.6
Total (n)	(216)	(86)	(72)
Long Term[2]			
Fossil fuels	23.9	38.1	29.6
Solar/wind/conservation	15.1	4.8	3.7
Nuclear	23.3	42.3	40.7
Biomass	37.7	14.8	25.9
Total (n)	(159)	(189)	(27)

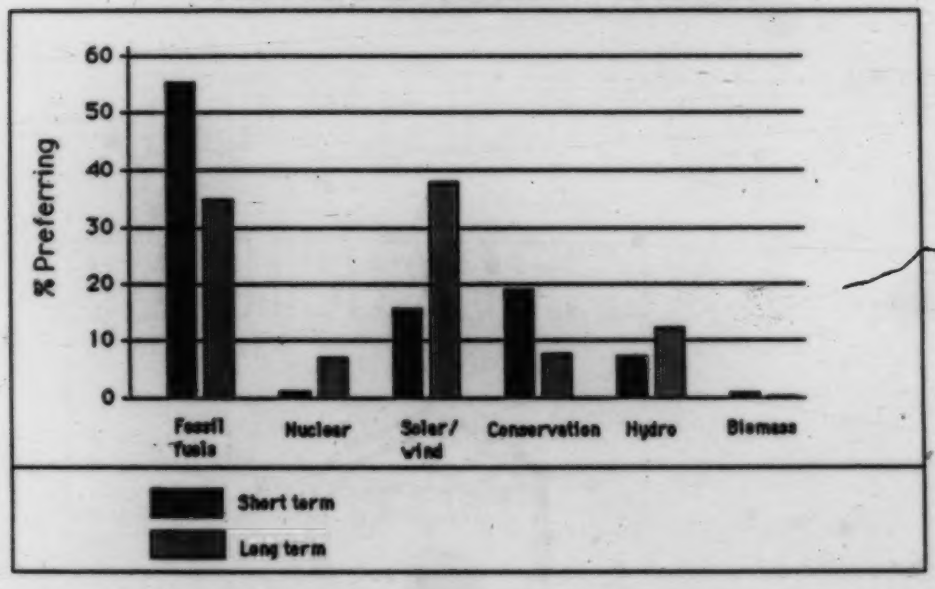
[1]Chi-square = 19.11; d.f. = 6; $p < 0.004$
[2]Chi-square = 44.13; d.f. = 6; $p < 0.0001$

5.6 Discussion

A substantial shift in energy preferences was evident between the short and long term (Figure 5.1). Most notable were the changes in preference for the fossil fuels and solar and wind energy. While over half of the respondents cited one of the fossil fuels as their most preferred option in the short term, only about one-third felt that these resources should be emphasized the most in the long term. Conversely, support for solar and wind energy

increased markedly; more than twice as many respondents supported these options for the long term compared to the short term. Although almost one-fifth of the respondents listed an energy conservation option as their most preferred short term option, less than 10% concurred for the long term. Both nuclear power and hydro electricity were perceived more favourably in the long term than the short term.

FIGURE 5.1
SHORT VS. LONG TERM ENERGY PREFERENCES



With respect to the major energy categories, preferences for renewable resources more than doubled between the short and long term (24.0% to 50.1%), while support for nonrenewable options declined (57.0% to 42.0%). Support for energy conservation declined as well, as reported above. These results are comparable to those reported by Jackson (in press) who reviewed the results of four questionnaire surveys conducted in Calgary and Edmonton between 1981 and 1985 (see Chapter 2).

When comparing the results of the questionnaire survey to the energy scenarios reviewed earlier (see Chapter 3), two important similarities emerge. First, a transition away from the present dependence on nonrenewable energy resources is acknowledged both by the

public and in the energy forecasts. Second, the assurance of long term energy security was deemed important by substantial numbers of the public as well as by the different forecasting agencies regardless of the type of energy future they envisaged.

As was the case with the energy scenarios, where the transition from conventional oil was viewed as either a continuation of the dependence on nonrenewable energy resources, or where increased emphasis could be given to renewable resources and energy conservation, the public also reflected this dichotomy when the energy options were considered in these terms. Furthermore, the reasons cited by the sub-groups of the public which preferred one or the other of these strategies were consistent with those of the forecasting agencies. Specifically, supporters of nonrenewable energy emphasized job creation and economic growth, as did the Economic Council of Canada (ECC) and the Energy Resources Conservation Board (ERCB). Alternatively, concern over the environment and wasteful energy practices was associated with the supporters of renewable energy and energy conservation both among the public as well as the authors of the Friends of the Earth (FOE) and Alberta Environmental Network (AEN) energy scenarios. However, when the energy options as rated by the public were analysed in terms of the "general categories" (i.e. fossil fuels, solar and wind energy, nuclear power, biomass). differences between the public's perception and the energy mix outlined by the different agencies can be noted, particularily amongst respondents most preferring renewable resources.

The energy scenarios proposed by FOE and AEN placed a great deal of emphasis on biomass as a major source of energy. Indeed, FOE projected that by 2025 biomass sources would supply over half of Canadian energy needs. Few members of the public concurred with these projections. Less than 1% of the respondents listed biomass as their most preferred short or long term option, and approximately one-quarter felt that it should be emphasized the least in both time periods. Public concern over possible environmental impacts, long term energy security, and the perception that biomass use is economically unrealistic, prohibits its widespread acceptance. This concern may partly stem from reports in various media about the state of the Canadian forestry industry, particularly in the areas of prudent management

and reforestation efforts. It may also be the result of the relatively recent consideration (by some parties) of biomass as a major energy source and that the public is not fully aware of all of the issues surrounding its use. Whatever the reason, the public's perception of biomass could prove to be a major obstacle to those organizations wishing to promote its widespread use.

Although the authors of both the FOE and AEN reports gave serious consideration to the use of active solar and wind energy, these sources are only expected to contribute a relatively small amount to the total energy supply system. Members of the public, however, strongly favour their development (particularly solar energy) as long term energy resources. Indeed, over one-third of the sample indicated that these options should be emphasized the most in the long term and less than 7% felt that they should be emphasized the least. Reasons related to the environment and long term energy security were cited to support this view. Although the level of optimism expressed by the public may be misplaced given the current level of technological development and implementation practices, a substantial proportion of the public perceive that they can, and should, be major energy supply sources beyond the turn of the century. Increased efforts to promote the development and use of solar and wind energy are therefore likely to meet with public approval.

Energy conservation measures were most preferred by about 20% of the sample in the short term but only by about 8% in the long term. Although the reasons given by the respondents for their preferences were consistent with those outlined by the authors of the FOE and AEN studies (i.e. reducing energy wastage and environmental impacts and increasing energy security), the public's emphasis on the short term is at odds with the proposals outlined in the two energy scenarios. The public may feel, however, that conservation practices should be promoted at present and in the near future, but in the long term, a high degree of energy efficiency will have been achieved (or suitably institutionalised) and more emphasis can then be placed on developing alternative energy supply sources. Alternatively, there may be a perception that energy conservation is a "transitional, stop-gap measure on the way to an energy abundant future, but not a dependable long term strategy"

(Jackson, in press).

For respondents who most preferred nonrenewable energy options in both time periods, not only were their reasons for choosing these options consistent with those outlined in the ECC and ERCB forecasts, but their emphasis on the different energy sources was also comparable. For example, of the respondents most preferring the fossil fuels in the short term, the majority cited conventional oil. Oil from the tar sands and natural gas were the next two most frequently cited options. For the long term, a shift in preferences was found amongst those most preferring the fossil fuels. Over a third of these repondents felt that the oil sands should be emphasized, followed by off-shore oil, conventional oil, and natural gas.

Nuclear power, although favoured by the ECC, was not perceived by a large portion of the sample as an option to be emphasized in either the short or long term. In fact, it was the least preferred option in both time periods, mainly due to the perceived environmental consequences resulting from its development and use. Opposition to the development of nuclear power can therefore be expected from a substantial portion of the public.

In conclusion, the data presented in this chapter indicate that the urban Albertan public generally favours a transition from a society dependent solely on nonrenewable resources to one where renewable resources play an important if not dominant role. The majority of respondents who most preferred renewable energy options and energy conservation did so for generally the same reasons as those expressed in the FOE and AEN energy scenarios. However, these respondents placed significantly more emphasis on solar and wind energy than did the authors of the FOE and AEN studies. In the energy scenarios developed by these organizations, biomass is expected to be the major source of renewable energy in the upcoming century. Respondents who most preferred the continued use of nonrenewable energy resources in the long term held perceptions that were consistent with the ECC and the ERCB both in terms of the mix of energy options and the reasons for their choice.

6. ENVIRONMENTAL ATTITUDES

6.1 Scale Formation

A series of twenty-one statements was used to measure respondents' attitudes and values towards a number of issues related to mankind's relationship with the environment. A five point scale followed each statement. Raw scores for some statements were reversed so that a low score consistently represented a pro-environmental perspective (see Table 4.1).

To facilitate data analysis and interpretation, respondents were classified into one of a series of categories on the assumption that individuals with the same scores would share similar attitudes and beliefs. The theoretical range of the scale was 21 to 105. The actual range was 24 to 91. Because responses to the statements approximated a normal distribution (skewness=0.18), the mean and standard deviation were used as points of division to form four groups (Table 6.1). Individuals with scores more than one standard deviation below the mean and therefore representing the most environmentally-oriented group, were described as "ecocentrists" (13.6% of the sample); those with less than one standard deviation below the mean as "moderate ecocentrists" (37.4%); those with less than one standard deviation above the mean as "moderate technocentrists" (32.6%); and those with greater than one standard deviation above the mean as "technocentrists" (16.4%).

TABLE 6.1
ENVIRONMENTAL ATTITUDE SCALE SUB-GROUPS

Orientation	Scale Score Range	N	%
Ecocentrics	24-42	53	13.6
Moderate Ecocentrics	43-53	149	37.4
Moderate Technocentrics	54-64	127	32.6
Technocentrics	65-91	64	16.4
Total	—	(393)	100.0

It is worthwhile to note that the observed mean did not coincide with the theoretical mean. Indeed, the results suggest that the public has adopted generally "ecocentric" attitudes towards the environment. This result is consistent with those found by Dunlap and Van Liere

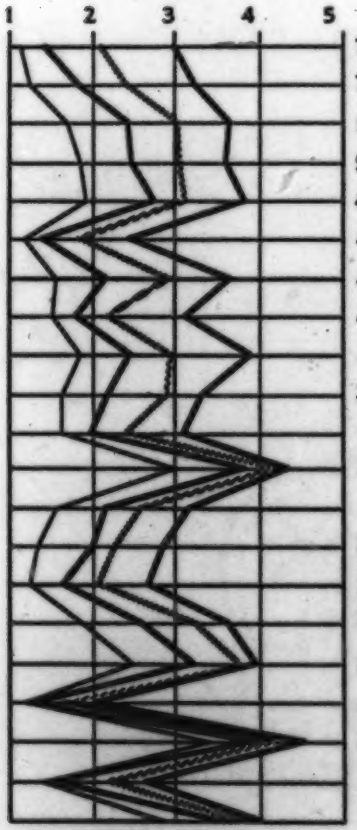
(1978; 1984), Farbrother (1985), Jackson (1986), and Rodgers (1987).

An analysis of variance was carried out to validate the appropriateness of the classification procedure. Using the SPSSx Breakdown procedure, the mean score for each attitude statement broken down by the four groups defined above was calculated. The mean scores varied significantly and in the expected direction; ecocentrists consistently had the lowest mean scores, moderate ecocentrists the second lowest, moderate technocentrists the second highest, and technocentrists had the highest mean scores. Ecocentrists and moderate ecocentrists all had mean scores below the sample mean for each statement while the reverse was the case for moderate technocentrists and technocentrists (Figure 6.1). In no instance was there a deviation from this pattern.

To validate further the classification of the respondents in the manner described above, cluster analysis of the responses to the twenty one statements was undertaken. The SAS FASTCLUS procedure was used. This procedure first determines initial cluster seeds in the data set and then uses a standard iterative alogrithm to minimize the sum of squared distances from the cluster means. Four clusters were specified. The resulting cluster groups were crosstabulated against the four attitudinal groups described above. As shown in Table 6.2, a very stong relationship was apparent. Clusters 1 and 4 were strongly related to the ecocentric and technocentric modes respectively. In fact, all respondents classified as ecocentrists emerged in Cluster 1 while the vast majority (91%) of technocentrists were in Cluster 4. The strong compatibility of the results based on the mean/standard deviation method and those found through cluster analysis lends credibility to the aggregation procedure employed initially. Indeed, both methods basically arrived at the same solution.

To establish which taxonomy would be used, an analysis of variance was also conducted with the four cluster groups and the original twenty-one attitude statements. Although the mean scores for each group were all statistically significant and in the expected direction ($p<0.0001$ in each case), the extremes were less pronounced than those found using the mean/standard deviation procedure. As a result, the latter taxonomy will be employed for the remainder of the thesis.

FIGURE 6.1
ENVIRONMENTAL ATTITUDE SCALE: MEAN SCORES



F**	Statements***
78.78	Mankind abusing environment
71.46	Disastrous consequences
53.86	Science and technology do harm
53.91	Reduce consumption
48.15	Teach children about nature
47.79	Balance of nature easily upset
46.93	Cannot count on science
45.73	Rapid growth creates problems
41.21	Approaching limits to people
38.18	Limits to growth
32.58	Growth outweighs consequences
32.25	Raise standards through science
29.71	Right to modify environment
29.34	Rule over nature
29.24	Need not adapt to environment
27.38	No limits to living standards
27.36	Solve problems with technology
26.82	Harmony with nature
25.51	Better if growth stopped
25.42	Earth like spaceship
19.03	Economic growth beneficial

Ecocentric
Moderate Ecocentric
Moderate Technocentric
Technocentric

* Mean scores based on (1) strongly agree to (5) strongly disagree.
**All statements significant at $p < 0.0001$.
*** See Table 4.1 for complete statements.

TABLE 6.2
CROSSTABULATION: CLUSTER ANALYSIS AND MEAN/STANDARD DEVIATION CLASSIFICATION PROCEDURES

Cluster	Environmental Orientation			
	Ecocentric			Technocentric
	1 %	2 %	3 %	4 %
1	100.0	38.4	0	0
2	0	43.8	54.3	0
3	0	17.8	22.8	9.4
4	0	0	22.8	90.6
Total (n)	(53)	(146)	(127)	(64)

Chi-square = 409.53; d.f. = 9; $p < 0.0001$

6.2 Factor Analysis

The measurement of environmental attitudes in terms of paradigms or world views provides a better means towards understanding individuals' preferences and expectations about energy development and use (see Chapter 2). However, if comparisons are to be possible between and within populations on both a spatial and temporal basis, the measurement of values and attitudes must be standardized and reliable. In this section, the attitude scale used in the present study will be compared to the same scale used by Jackson (1986) who administered it to a random sample of households in Calgary and Edmonton during the summer of 1984. Factor analysis was undertaken to determine the number and type of dimensions (factors) present in both scales. If the factors that emerge and the items within each factor are consistent in both scales, it would attest to the stability of the scales as measures of individuals' attitudes towards the environment.

Only factors contributing more than 5% to the total explanation were selected because, as King (1969) has argued, components contributing less than 5% have too large a random-error variance. The factor loadings, based upon a principal component model with a varimax rotation, are presented in Table 6.3. Four factors were found which collectively explained 49.6% of the total variance in the data matrix. None of the variables had factor loadings of less than 0.40 and were therefore all retained. Cronbach's *alpha* coefficient of

reliability was used to determine the relative homogeneity of variables for the entire scale and within each factor. Test scores range between zero and unity; a score of 0.40 or greater is generally considered to be an acceptable level of reliability. The *alpha* score for the entire scale was 0.84 and 0.80, 0.70, 0.66, and 0.56 for Factors 1 through 4 respectively.

With the exception of one attitude variable, the factors found in this study replicated those found by Jackson (1986). As shown in Table 6.3, the factor loadings, the percent of variance explained, and Cronbach's *alpha* score of reliability for the entire scale and each factor were similar for both studies.

The four dimensions emerging from the factor analysis exhibited conceptual as well as statistical consistency. Factors 1 and 3 included items that were overtly related to societal and technological issues. In Factor 1, ("Consequences of growth and technology"), three of the eight statements were concerned with economic growth, while the remaining ones focused on various issues arising from the application of science and technology. Four items comprised the "Quality of life " dimension (Factor 3). Included here were statements dealing with perceived relationships among the issues of the standard of living, economic growth, and science and technology.

An explicitly environmental focus emerged in the two remaining factors. Statements regarding the relationship between man and the environment loaded highly on Factor 2; specifically, the issue of mankind's perceived right to dominate nature was addressed. Statements concerned with limits to the biosphere comprised Factor 4.

The only discrepancy between the present study and Jackson's 1984 study in terms of item loadings occurred with respect to the latter two factors. The statement "The balance of nature is very delicate and easily upset" loaded on Factor 2 in the present study while it loaded on Factor 4 in the 1984 survey. Although the item did not load on the same factor in both cases, it still emerged in a conceptually similar dimension in both cases.

TABLE 6.3
VARIMAX ROTATED MAJOR FACTOR LOADINGS FOR THE ENVIRONMENTAL ATTITUDE STATEMENTS: COMPARISON OF THE 1984 AND 1986 RESULTS

Factors/Items	1984	1986
The Consequences of Growth and Technology		
Science and technology often do as much harm as good	0.69	0.71
More emphasis should be placed on teaching children about nature than on teaching them about science and technology	0.68	0.69
When humans interfere with nature, it often produces disastrous conseqeuences	0.66	0.78
We cannot keep counting on science and technology to solve mankind's problems	0.56	0.45
Mankind is severely abusing the environment	0.56	0.55
Rapid economic growth often produces more problems than benefits	0.52	0.52
Canadians are going to have to reduce their consumption of material goods over the next few years	0.52	0.57
In general, the Canadian people would be better off if the nation's economy stopped growing	0.48	0.55
Percent of total variance explained	**21.1**	**25.3**
Cronbach's *alpha*	**0.78**	**0.80**
Relationship Between Man and Nature		
Humans need not adapt to the environment because they can remake it to suit their needs	0.73	0.71
Humans have the right to modify the environment to suit their needs	0.66	0.65
The positive benefits of economic growth far outweigh any consequences	0.63	0.46
Mankind was created to rule over the rest of nature	0.60	0.60
Humans must live in harmony with nature in order to survive	0.54	0.58
The balance of nature is very delicate and easily upset	---	0.52
Percent of total variance explained	**8.9**	**10.3**
Cronbach's *alpha*	**0.68**	**0.70**

Quality of Life		
We can continue to raise our standard of living through the application of science and technology	0.72	0.66
Economic growth improves the quality of life for all Canadians	0.64	0.68
In the long run, there are no limits to the extent to which we can raise our standard of living	0.58	0.57
Most problems can be solved by applying more and better technology	0.58	0.73
Percent of total variance explained	8.2	7.7
Cronbach's *alpha*	0.62	0.66
Limits to the Biosphere		
The earth is like a spaceship with only limited room and resources	0.72	0.78
There are limits to growth beyond which our industrialized society cannot expand	0.63	0.72
We are approaching the limit to the number of people the earth can support	0.60	0.42
The balance of nature is very delicate and easily upset	0.44	
Percent of total variance explained	6.0	6.3
Cronbach's *alpha*	0.58	0.56
Total Scale:		
Percent of total variance explained	44.4	49.6
Cronbach's *alpha*	0.82	0.84

It can be concluded that the attitudes scale used in this study and by Jackson (1986) consistently measured four distinct dimensions of environmental attitudes, namely, the consequences of growth and technology, the quality of life, relationships between man and the environment, and limits to the biosphere. With one exception, the twenty-one items loaded on the same factors in both studies, thus providing evidence of the ability of the scales to measure consistently individuals' attitudes towards the environment.

6.3 Energy Preferences

6.3.1 Environmental Attitudes and Energy Preferences

To determine the nature and extent of the association between environmental attitudes and respondents' evaluations of energy options, an analysis of variance was conducted. As shown in Table 6.4, eleven energy options were statistically associated with environmental attitudes. Of the four options not statistically related, three received uniformly low ratings (coal, wood for heating, and wood for conversion to methanol), while natural gas was rated favourably by respondents in all attitudinal categories.

With the exception of the two biomass options which were not statistically related to environmental attitudes, ecocentrists rated the renewable and conservation options more favourably than did technocentrists. For example, ecocentrists evaluated building standards (mean=4.03), conservation by industy (4.51), and solar energy (4.06) significantly higher than did technocentrists (building standards, 3.20; conservation by industry, 3.86; solar energy, 3.11). In all cases where significant relationships were apparent, the increase or decrease in mean scores was consistent with the respondents' environmental orientation.

Interrelationships between environmental attitudes and repondents' short and long term energy preferences were also analyzed. The results of the crosstabulation analysis between the major energy categories for the short and long term and environmental orientation are presented in Table 6.5. For both temporal periods, ecocentrists more frequently preferred renewable resources and energy conservation than did technocentrists. The latter group, on the other hand, preferred nonrenewable energy resources more frequently than did ecocentrists. In the short term, for example, over three-quarters of the technocentrists preferred nonrenewable energy compared to about half of the ecocentrists. Comparable figures for the long term were 56.3% of technocentrists preferring nonrenewable options compared to 32.1% of the ecocentrists. Conversely, in the long run, preferences for renewable forms of energy were highest among ecocentrists (56.6%), and declined steadily to under forty percent for technocentrists. The trends related to the energy conservation options

TABLE 6.4
MEAN SCORES: THE INFLUENCE OF ENVIRONMENTAL ATTITUDES ON ENERGY PERCEPTIONS

		Ecocentric			Technocentric		
	Mean	1	2	3	4	F	P<
Coal for electricity	2.65	2.53	2.72	2.56	2.78	0.92	N.S.
Conventional oil	3.57	3.30	3.43	3.67	3.88	4.76	0.002
Off-shore oil	3.14	2.70	3.14	3.19	3.39	3.99	0.008
Wind	3.16	3.57	3.41	2.92	2.73	6.48	0.0003
Solar	3.69	4.06	3.88	3.60	3.11	7.95	0.0001
Nuclear	2.28	1.88	2.04	2.43	2.86	8.58	0.0001
Tarsands	3.60	3.21	3.62	3.54	4.02	5.68	0.0008
Hydro electricity	3.68	3.31	3.61	3.83	3.84	3.66	0.01
Natural gas	3.91	3.75	3.85	3.94	4.11	1.89	N.S.
Public conservation	3.90	4.21	4.08	3.73	3.58	5.29	0.001
Industrial conservation	4.13	4.51	4.29	3.91	3.86	7.36	0.0001
Wood for heating	1.96	2.04	2.08	1.90	1.75	1.66	N.S.
Wood for gas	2.20	2.06	2.31	3.21	2.05	1.22	N.S.
Building standards	3.78	4.03	4.00	3.70	3.20	20.07	0.0001
Product standards	3.74	4.11	3.97	3.58	3.19	10.86	0.0001

were not as consistent as those presented above, although ecocentrists cited these options as being the best in the short and long term more frequently than did technocentrists.

TABLE 6.5
ENVIRONMENTAL ATTITUDES AND PREFERENCES FOR ENERGY OPTIONS

	Environmental Orientation			
	Ecocentric			Technocentric
	1	2	3	4
	%	%	%	%
Short Term[1]				
Nonrenewable	49.1	51.0	58.1	76.6
Renewable	30.2	22.8	25.8	15.6
Conservation	20.8	26.2	16.1	7.8
Total (n)	(53)	(145)	(124)	(64)
Long Term[2]				
Nonrenewable	32.1	35.7	44.8	56.3
Renewable	56.6	52.4	52.0	37.5
Conservation	11.3	11.9	3.2	6.3
Total (n)	(53)	(143)	(125)	(64)

[1] Chi-square = 17.51; d.f. = 6; $p < 0.007$
[2] Chi-square = 15.91; d.f. = 6; $p < 0.01$

6.3.2 Environmental Attitudes and Reasons for Choice

Relationships between respondents' environmental orientation and reason for choosing a specific energy option in both the short and long term were found to be statistically significant. With respect to the short term, technocentrists more frequently cited the reasons of job creation (12.7%), economic efficiency (31.7%), and economic growth (12.7%) than did ecocentrists (9.6%, 7.7%, and 9.6% respectively; Table 6.6). Having fewer environmental effects and energy wastage, however, were reasons cited more frequently by ecocentrists (23.1% and 19.2%) than by technocentrists (4.8% and 4.8%). Long term energy security was important to ecocentrists (19.2%) and technocentrists (25.4%) alike.

TABLE 6.6
ENVIRONMENTAL ATTITUDES AND MOST IMPORTANT REASON FOR SHORT TERM ENERGY PREFERENCES

Reason	Environmental Orientation			
	Ecocentric			Technocentric
	1 %	2 %	3 %	4 %
No alternatives	9.6	4.3	2.4	6.3
Create more jobs	9.6	15.1	17.7	12.7
Economic efficiency	7.7	15.8	12.1	31.7
Fewer environmental effects	23.1	21.6	11.3	4.8
More economic growth	9.6	8.6	13.7	12.7
Too much energy wasted	19.2	18.7	11.3	4.8
Diversify resource base	1.9	2.9	7.3	1.6
Long term security	19.2	12.9	24.2	25.4
Total (n)	(52)	(139)	(124)	(63)

Chi-square = 50.87; d.f. = 21; $p < 0.0003$

Similar trends were found with respect to the long term (Table 6.7). A sizeable percentage of respondents from each attitudinal category listed long term energy security as the most important reason for their choice. Indeed, over a third of all the respondents (35.2%) felt that their choice of energy option would provide the energy needed for the longest time. Beyond this reason, however, differences between respondents in the different attitudinal categories were found. Specifically, the reasons of economic efficiency (25.8%) and job creation (12.9%) were more likely to be cited by technocentrists. Only 4.0% of the ecocentrists felt that economic efficiency was the most important reason and none listed job creation. Having fewer environmental effects and wasteful energy practices were reasons chosen more frequently by ecocentrists (34.0% and 16.%) than technocentrists (9.7% and 1.6%).

In general, consistent results were found between the different attitude groups and the most important reason for their choice of energy option in both the short and long term. Ecocentrists placed more emphasis on the environment and wasteful energy practices than did technocentrists. Economic efficiency and job creation were more important to technocentrists. The only reason which that was noted with equal frequency by all attitude groups was that of ensuring long term energy security.

TABLE 6.7
ENVIRONMENTAL ATTITUDES AND MOST IMPORTANT REASON FOR LONG TERM ENERGY PREFERENCES

Reason[1]	Environmental Orientation			
	Ecocentric			Technocentric
	1 %	2 %	3 %	4 %
Create more jobs	0.0	6.0	11.7	12.9
Economic efficiency	4.0	14.2	15.8	25.8
Fewer environmental effects	34.0	29.9	14.2	9.7
More economic growth	4.0	6.0	6.7	4.8
Too much energy wasted	16.0	9.0	3.3	1.6
Diversify resource base	2.0	6.7	6.7	11.3
Long term security	40.0	28.4	41.7	33.9
Total (n)	(50)	(134)	(120)	(62)

Chi-square = 51.16; d.f. = 18; $p < 0.0001$
[1] Excluding the reasons "no alternatives" and "more agreeable society".

6.3.3 Reasons for Choice as an Intervening Variable

The results from the above analyses were not entirely unexpected given the relationships found earlier between respondents' environmental attitudes and energy preferences, and the associations between energy preferences and the reasons for choice variables. For example, it was determined earlier that respondents who preferred renewable resources cited the reasons of security, environmental effects, and wasteful energy practices more frequently than did respondents who preferred nonrenewable resources. Once it was established that ecocentrics preferred renewable resources more frequently than did technocentrics, it could be inferred that their reason for choosing these options would be related to security, the environment, and wasteful energy practices.

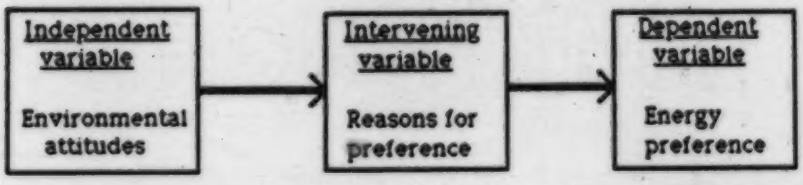
This relationship can be verified statistically by determining if respondents' reason for choosing a specific long term energy option (or category of energy options) was an intervening variable between environmental attitudes and their actual preferences (Figure 6.2). The logical status of an intervening variable is that it is viewed as a consequence of the independent variable and as a determinant of the dependent variable; if it were not for the intervening variable, there would be no association between the independent and dependent

variables.

To establish a variable as intervening requires the presence of three asymmetrical relationships. Specifically, three criteria must be met (Rosenberg, 1968, p. 57):

1. The original relationship between the independent and dependent variables;
2. A relationship between the independent variable and the test factor (intervening variable);
3. A relationship between the test factor and the dependent variable.

FIGURE 6.2
RELATIONSHIP BETWEEN VARIABLES



The first criterion (i.e. the relationship between attitudes and energy preferences) has already been established (see Table 6.5). Although the second and third criteria have also been fulfilled (see Table 6.7 and Table 5.9), the reasons for choice variables will be aggregated to prevent data fragmentation. Attention will therefore be given initially to delineating the new categories.

Factor analysis was undertaken to determine the number and type of dimensions (factors) contained in the long term reasons for choice variables. It was expected that the reasons relating to the environment would load together as would the economic-related reasons. The factor loadings, based upon a principal component model with a varimax rotation, are presented in Table 6.8. Three factors were found which collectively explained 56.5% of the total variance in the data matrix. One of the variables ("There are no other alternatives") had a factor loading of less than 0.40 and was therefore excluded from subsequent analysis. Cronbach's *alpha* coefficient of reliability for the entire scale (0.64) and for each factor (0.59, 0.60, and 0.41 for Factors 1 to 3 respectively) were suitably high to indicate the relative homogeneity of the factors.

TABLE 6.8
VARIMAX ROTATED FACTOR LOADINGS FOR THE REASONS FOR LONG TERM ENERGY PREFERENCE VARIABLES

Factors/Items	Factor 1	Factor 2	Factor 3
Economic			
It has the advantage of creating the most jobs	**0.89**	0.03	-0.02
It will stimulate more growth in the economy	**0.87**	-0.02	0.07
It is the most economically efficient option	**0.42**	0.14	0.38
There are no other alternatives*	**0.37**	0.20	0.19
Environmental			
Too much energy is now being wasted	0.16	**0.77**	-0.18
Its environmental effects are less than those of the other options	-0.17	**0.71**	0.34
It will lead to a more agreeable society	0.11	**0.68**	0.17
Security			
It will provide the energy we need for the longest time	0.01	0.05	**0.85**
It will diversify Canada's energy resource base	0.40	0.05	**0.46**
% of variance explained	**27.0**	**18.3**	**11.2**

Total variance explained 56.5%
* deleted from analysis due to low factor loading.

The three factors conformed to expectations. Economic reasons comprised Factor 1 (job creation, economic growth, and economic efficiency). Factor 2 contained three variables related to the environment or an "environmental perspective": too much energy wasted; fewer environmental effects; and more agreeable society. Reasons related to security and diversification comprised Factor 3. The three factors will be referred to as Economic, Environmental, and Security respectively.

Having established three categories for the most important reason for choosing a long term energy option, it was necessary to reestablish the relationships between the new variables and environmental attitudes and energy preferences with respect to the second and third criteria outlined above.

In accordance with the second criterion, crosstabulation analysis between the independent variable and the test factor was conducted (Table 6.9). Significant differences were found between respondents' environmental attitudes and their most important reason for choosing a long term option. Specifically, technocentrists (42.9%) more frequently cited economic reasons than did ecocentrists (7.8%), while the latter group were more apt to support reasons related to environment (51.0%) than were technocentrists (12.7%). Over a third of the respondents in each attitudinal category listed reasons related to long term energy security as the most important.

TABLE 6.9
ENVIRONMENTAL ATTITUDES AND REASONS FOR LONG TERM ENERGY PREFERENCE (RECODED)

	Environmental Orientation			
	Ecocentric			Technocentric
Reasons	1 %	2 %	3 %	4 %
Economic	7.8	25.7	34.3	42.9
Environmental	51.0	39.7	17.5	12.7
Security	41.2	34.6	48.3	44.4
Total (n)	(51)	(136)	(120)	(63)

Chi-square = 41.44; d.f. = 6; $p < 0.0001$

An asymmetrical relationship between the test factor (reasons) and the dependent variable (preferences) was also verified as specified by the third criterion. The majority of respondents citing economic reasons preferred nonrenewable resources as long term energy options (60.9%; Table 6.10). Preferences for renewable options were more strongly associated with environmental reasons (73.0%). The issue of long term security was important to over 45.0% of respondents preferring both nonrenewable and renewable options. Less than 10.0% of the respondents choosing either of the three reasons preferred conservation measures.

TABLE 6.10
MOST IMPORTANT REASON FOR CHOICE (RECODED) AND LONG TERM ENERGY PREFERENCES

Energy Preference	Reasons		
	Economic %	Environmental %	Security %
Nonrenewable	60.9	17.1	45.6
Renewable	31.8	73.0	48.1
Conservation	7.3	9.9	6.3
Total (n)	(110)	(111)	(158)

Chi-square = 46.34; d.f. = 4; $p < 0.0001$

Having established the asymmetry of the relationships between the three pairs of variables, analysis can now proceed to verify the "reasons" variables as intervening by crosstabulating environmental attitudes against energy preferences, while controlling for reasons. The relationship between attitudes and preferences should disappear when reasons are controlled. As shown in Table 6.11, no statistically significant differences were found. For example, among the sub-group who cited economic reasons, the majority in each attitudinal category preferred nonrenewable options. Among the sub-group citing environmental reasons, the majority in each attitudinal category preferred renewable resources (e.g. ecocentrists, 76.9%; technocentrists, 62.5%). Similarities between respondents' environmental attitudes and energy preferences were also found among the portion of the sample citing reasons related to long term energy security.

Differences between the attitudinal groups, however, were not completely eliminated. Thus, the reasons for choice could not be considered the only explanation. Nevertheless, this analysis has demonstrated that the reasons variables were a major factor in influencing respondents' energy preferences. If it were not for the factor of "reasons for choice", ecocentrists and technocentrists would not have significantly different energy preferences. The logical status of the variable was also apparent: it was an intervening variable, simultaneously a consequence of environmental attitudes and a determinant of long term energy preferences.

TABLE 6.11
ENVIRONMENTAL ATTITUDES AND LONG TERM ENERGY PREFERENCE, BY REASONS FOR CHOICE

Energy Preferences	Economic[1]				Environmental[2]				Security[3]			
	Eco-centric 1 %	2[4] %	3 %	Techno-centric 4 %	Eco-centric 1 %	2 %	3[5] %	Techno-centric 4 %	Eco-centric 1 %	2 %	3 %	Techno-centric 4 %
Nonrenewable	—	66.7	56.1	59.3	11.5	13.2	20.7	—	42.9	42.6	43.1	60.7
Renewable	—	20.5	43.9	29.6	76.9	73.6	75.9	—	47.6	48.9	50.0	39.3
Conservation	—	12.8	0.0	11.1	11.5	13.2	3.4	—	9.5	8.5	6.9	0.0
Total (n)	—	(39)	(41)	(27)	(26)	(53)	(29)	—	(21)	(47)	(58)	(28)

[1] Chi-square = 8.91; d.f. = 4; (N.S.)
[2] Chi-square = 2.80; d.f. = 4; (N.S.)
[3] Chi-square = 4.51; d.f. = 6; (N.S.)
[4] For the purposes of analysis, environmental attitude categories 1 and 2 were combined.
[5] For the purposes of analysis, environmental attitude categories 3 and 4 were combined.

6.4 Least Preferred Energy Options

6.4.1 Environmental Attitudes and Least Preferred Energy Options

Relationships between respondents' environmental orientation and the energy options they felt should be emphasized the least in the short and long term were statistically significant (Table 6.12). Due to the low number of respondents who felt the conservation options should not be emphasized (less than 2.2% for both time periods), they were combined with respondents in the renewable energy category.

TABLE 6.12
ENVIRONMENTAL ATTITUDES AND LEAST PREFERRED ENERGY OPTIONS

	Environmental Orientation			
	Ecocentric			Technocentric
	1 %	2 %	3 %	4 %
Short Term[1]				
Nonrenewable	70.2	65.7	59.2	42.6
Renewable[2]	29.8	34.3	40.8	57.4
Total (n)	(47)	(140)	(120)	(61)
Long Term[3]				
Nonrenewable	74.5	72.3	62.8	50.8
Renewable[4]	25.5	27.7	37.2	49.2
Total (n)	(47)	(137)	(121)	(61)

[1]Chi-square = 11.67; d.f. = 3; $p < 0.008$
[2]Includes energy conservation options.
[3]Chi-square = 10.68; d.f. = 3; $p < 0.01$
[4]Includes energy conservation options.

For both the long and short term, ecocentrists more frequently rated nonrenewable energy resources as their least preferred options than did technocentrists. Indeed, the more technocentrically oriented respondents were, the less likely they were to rate the nonrenewable energy resources unfavourably. The opposite was evident with respect to the renewable energy resources where significantly fewer econcentrists than technocentrists rated them as options to be emphasized the least.

6.4.2 Environmental Attitudes and Reasons for Choice

Respondents were asked to evaluate five reasons with regard to the energy option they felt should be emphasized the least in the long term. The "most important reason" variable was crosstabulated with the attitudinal categories (Table 6.13). As was the case with the reasons for the most preferred energy options, a sizeable proportion of respondents from each attitudinal category cited the reason relating to long term energy security as the most important (e.g. ecocentrists, 20.9%; technocentrists, 30.5%). The reason "less agreeable society" was considered as the most important by less than 4.0% of respondents in each attitude category. Substantial differences, however, were found between the remaining three reasons and environmental orientation. Specifically, while almost two-thirds of the ecocentrists felt that "serious environmental effects" was the most important reason, only one quarter of the technocentrists concurred. Conversely, being economically unrealistic was listed as the most important reason more frequently by technocentrists (30.5%) than by ecocentrists (4.7%). Potential loss of jobs was also more important to technocentrists (10.2%) than to ecocentrists (7.0%).

TABLE 6.13
ENVIRONMENTAL ATTITUDES AND MOST IMPORTANT REASON FOR LEAST PREFERRED LONG TERM ENERGY OPTION

Reason	Environmental Orientation			
	Ecocentric 1 %	2 %	3 %	Technocentric 4 %
Economically unrealistic	4.7	13.7	21.4	30.5
Loss of jobs	7.0	9.2	7.7	10.2
Serious environmental effects	65.1	55.7	39.3	25.4
No security	20.9	17.6	26.5	30.5
Less agreeable society	2.3	3.8	5.1	3.4
Total (n)	(43)	(131)	(117)	(59)

Chi-square = 29.04; d.f. = 12; $p < 0.003$

Overall, the results presented above are consistent with those presented earlier with respect to the most preferred options. Marked divergences between ecocentrists and technocentrists were evident in terms of the importance they attatched to the the different

reasons. Most notably, discrepancies occurred around the issues related to the environment and economics. The issue of long term energy security was important to a substantial proportion of respondents, regardless of their environmental orientation.

6.4.3 Reasons for Choice as an Intervening Variable

To prevent data fragmentation, the five reasons were grouped into three categories based on those established above (see section 6.3.3): (1) economic (economically unrealistic, loss of jobs); (2) environmental (serious environmental effects, less agreeable society); and (3) security (less security).

The same procedure as was undertaken with respect to the most preferred energy options was conducted again. An asymmetrical relationship between attitudes and least preferred options has already been established (Table 6.12). The results from crosstabulation analysis between the new reasons categories and environmental attitudes and least preferred energy options are presented in Tables 6.14 and 6.15 respectively. The results depicted in both Tables confirm those presented above and therefore fulfill the necessary criteria needed to establish the reasons as intervening.

TABLE 6.14
ENVIRONMENTAL ATTITUDES AND REASONS FOR LEAST PREFERRED LONG TERM ENERGY OPTIONS (RECODED)

Reasons	Environmental Orientation			
	Ecocentric 1 %	2 %	3 %	Technocentric 4 %
Economic	11.6	22.9	29.1	40.7
Environmental	67.4	59.5	44.4	28.8
Security	20.9	17.6	26.5	30.5
Total (n)	(43)	(131)	(117)	(59)

Chi-square = 23.73; d.f. = 6; $p < 0.0006$

TABLE 6.15
LEAST PREFERRED ENERGY OPTIONS AND MOST IMPORTANT REASON FOR CHOICE (RECODED)

Least Preferred Option	Reasons Economic %	Environmental %	Security %
Nonrenewable	52.6	78.7	48.1
Renewable	47.4	21.3	51.9
Total (n)	(97)	(178)	(81)

Chi-square = 31.09; d.f. = 2; $p < 0.0001$

No significant differences were found when crosstabulation analysis between the least preferred energy options and environmental attitudes, controlling for reasons, was conducted (Table 6.16). Differences between ecocentrists and technocentrists were least among the sub-group citing environmental reasons. Almost identical percentages of respondents from both attitudinal groups felt that nonrenewable resources should be emphasized the least (ecocentrists, 78.6%; technocentrists, 76.5%). Among the sub-group citing security reasons, the emphasis given to either nonrenewable or renewable options was roughly equal among all respondents, regardless of their environmental attitudes. Although more ecocentrists (60.0%) than technocentrists (37.5%) felt that nonrenewable options should be emphasized the least among those who cited economic reasons, the differences between the groups were not statistically significant.

The above results indicate again that the reasons for choice variable was an intervening variable: it was simultaneously a consequence of environmental attitudes and a determinant of least preferred energy options. It is important to note, however, that differences between the attitudinal groups were still apparent, and to consider the reasons for choice the only variable for explaining the variations in energy preferences would be misleading. Nonetheless, this analysis has demonstrated that they were a major factor in influencing respondents' least preferred energy options.

TABLE 6.16

ENVIRONMENTAL ATTITUDES AND LEAST PREFERRED LONG TERM ENERGY OPTION, BY REASONS FOR CHOICE

Least Preferred Energy Options	Economic[1]				Environmental[2]				Security[3]			
	Eco-centric			Techno-centric	Eco-centric			Techno-centric	Eco-centric			Techno-centric
	1 %	2 %	3 %	4 %	1 %	2 %	3 %	4 %	1 %	2 %	3 %	4 %
Nonrenewable	60.0	60.0	55.9	37.5	78.6	80.8	75.0	76.5	55.6	52.2	45.2	44.4
Renewable[4]	40.0	40.0	44.1	62.5	21.4	19.2	25.0	23.5	44.4	47.8	54.8	55.6
Total (N)	(5)	(30)	(34)	(24)	(28)	(78)	(52)	(17)	(9)	(23)	(31)	(18)

[1] Chi-square = 3.11; d.f. = 3; (N.S.)
[2] Chi-square = 0.65; d.f. = 3; (N.S.)
[3] Chi-square = 0.56; d.f. = 3; (N.S.)
[4] Includes conservation options.

6.5 Discussion

Two points can be made about the attitude scale used in this study. First, the measurement of environmental attitudes in terms of paradigms or world views allows for the identification of a set of interrelated attitudes and thus reflects recent changes in the measurement and analysis of peoples' relative position or stance towards the environment. In the past, behavioural geographers have typically measured single attitudes and attempted to relate them to specific preferences of perceptions. However, as Bunting and Guelke (1979) have correctly pointed out, a causal link between simple one-to-one measures is tenuous at best. The use of the paradigm concept applied to the study of environmental atttiudes, therefore, represents an important step in overcoming the assumption of a one-to-one relationship between attitudes and preference variables. Indeed, the results presented in this chapter demonstrate that a strong and consistent relationship between environmental attitudes and energy preferences is evident.

Second, the ability of the attitudes scale to measure four dimensions of environmental concern consistently was also demonstrated. The four dimensions (the consequences of growth and technology, the quality of life, relationships between man and the environment, and limits to the biosphere) correspond to the factors found by Jackson (1986) who administered the same scale approximately two years prior to the present study. This result further attests to the utility of the scale to measure consistent dimensions of environmental attitudes regardless of the sample population.

Significant differences were found between the attitudinal categories and the energy options respondents most and least preferred. Those described as ecocentrists generally preferred renewable resources and conservation, and felt that nonrenewable options (nuclear power and fossil fuels) should be emphasized the least. Conversely, technocentrists were more in favour of continued reliance on nonrenewable resources (mainly fossil fuels) and were more opposed to renewable energy options (mainly biomass).

Respondents in the different attitudinal categories also expressed, with one exception, divergent reasons for their choices of most and least preferred options. The reason of

providing energy for the longest time (i.e. security) was consistently cited by substantial numbers of respondents regardless of their environmental orientation or energy preferences. Beyond this reason, however, substantial and consistent differences were found. Ecocentrists overwhelmingly cited the reasons related to the environment as the most important for their most and least preferred options. Technocentrists, on the other hand, were more apt to include economic-related reasons as the most important for both their most and least preferred energy options.

The reasons for choice variables proved useful, therefore, for discovering the rationale behind energy preferences and for uncovering points of divergences or similarities between subsets of the sample. In this study, for example, it was found that the issue of long term energy security was important to a substantial proportion of respondents regardless of their attitudinal affiliation. Issues related to the environment and economic growth are where divergence occurs and over which potential conflicts are likely to arise.

The inclusion of the "reasons for choice" variable and the subsequent verification of its status as an intervening variable also broadens the understanding of the hypothesized link between attitudes and preferences. As Rosenberg (1968, p. 63) maintains:

> Any asymmetrical relationship between two variables is an abstraction from a never-ending causal chain. The greater one's understanding of the links in this chain, the better one's understanding of this relationship.

The intervening variable was one of these links. Indeed, respondents' "reasons for choice" were found to be the consequence of environmental attitudes and determinants of both their most and least preferred energy options. It can therefore be stated that individuals with ecocentric attitudes are highly likely to prefer renewable energy resources or conservation measures *because* these options are perceived to be environmentally less damaging, that they reduce wasteful resource practices, and they will lead to the greatest level of energy security. Conversely, it is highly likely that individuals with technocentrically oriented attitudes will favour nonrenewable energy options *because* they view these options as providing the greatest economic benefits as well as ensure an energy secure future.

For the public, energy preferences (and those options they least preferred) were consistent with the reasons they expressed for that choice, which in turn were consistent with their "world view" as measured on the "DSP-NEP continuum". This sequence is both logically and statistically valid.

The same components that were found among the public were also found in the energy scenarios reviewed earlier (see Chapter 3). Specifically, it was argued that regardless of the technique employed to determine energy futures (i.e. forecasting or backcasting), a subjective and conditional element was involved. Emanating from this stance, the major assumptions (rationale) incorporated into each study were outlined. For the Economic Council of Canada (ECC), energy development was viewed as an "engine of growth". By assuming that current governmental and regulatory structures and policies (which generally favour expansion and growth; see Elder, 1984) would remain intact, the Energy Resources Conservation Board (ERCB) also adopted a similar stance. For both Friends of the Earth (FOE) and Alberta Environmental Network (AEN), energy development was viewed as confronting and conforming to environmental constraints and encouraging substantial reductions in energy demand. As a result, two vastly different energy futures were proposed: one advanced by the ECC and the ERCB based predominately on nonrenewable resources and increased demand (albeit at lower rates than those experienced during the 1960s and 1970s); and one based on renewable resources and decreasing demand (FOE and AEN).

The projections outlined in both sets of scenarios were therefore consistent with the attitudes and values incorporated into the forecasting or backcasting models, and with the objectives and assumptions for choosing specific energy alternatives. In other words, it can be inferred that the objectives and assumptions incorporated into the formulation of the energy scenarios were a consequence of the "world views" adopted by the different agencies, and determinants of the choice of strategy to cope with the imminent transition from dependence on conventional oil. Given that this is true, it can also be inferred that the logical sequence related to energy preferences found among the public is also valid for interpreting the decision processes involved in preparing the energy scenarios.

7. VALUES ABOUT SOCIETY AND ENERGY

7.1 Introduction

Based on the results presented in the previous chapter, a profile of the respondents in the different attitudinal categories in terms of their energy preferences and rationale for choosing various options has been constructed. The purpose of the present chapter is to elucidate further areas of similarities and divergences between respondents with contrasting environmental orientations. Specifically, two sections of the questionnaire were devoted to eliciting respondents' social preferences and values, and their evaluations of objectives which could be incorporated into a strategy for energy development and use.

7.2 Societal Values

A series of twelve statements designed to find out about respondents' social preferences and ideals was included in the questionnaire. All statements were derived from Cotgrove (1982). Respondents were presented with a list of alternatives and were asked which they would emphasize in an ideal society. Four categories of alternatives (as defined by Cotgrove, 1982) were represented by the twelve statements: 1) wealth creation versus limits to growth; 2) market versus nonmarket; 3) authority versus participation; and 4) individual versus collective. As was the case with the environmental attitude scale, raw scores for statements implying an "anti-economic individualism" (i.e. anti-*status quo*) position were reversed so that a low score consistently represented this stance (see Table 4.2). Cronbach's *alpha* coefficient of reliability was sufficiently high to indicate suitable homogeneity in responses between items (0.58).

Respondents were classified into one of four categories based on their responses to all twelve alternatives in a manner similar to that done with the environmental attitude scale. The theoretical range of the scale was 12-84 and the theoretical mean was 48. The actual range and mean were 24-74 and 49.9 respectively. As the distribution closely approximated a normal one (skewness = -0.07), the use of the mean and standard deviation to create

categories was clearly justified. Respondents whose total score was more than one standard deviation below the mean were classified in the anti-economic individualism category (13.4%) while those repondents whose total score was more than one standard deviation above the mean were placed in the pro-economic individualism category (16.5). Two intermediate groups were also defined (each comprising approximately 35% of the sample (Table 7.1).

Generally, respondents classified as "anti-economic individualists" were in favour of a society where emphasis is placed on satisfying work, participation in decisions, and in which the supremacy of the market is subjected to the public interest. Conversely, respondents classified as "pro-economic individualists" are more supportive of economic growth, rewards for achievement, the operation of market forces, and authority (Cotgrove, 1982).

TABLE 7.1
SOCIETAL VALUES SCALE SUB-GROUPS

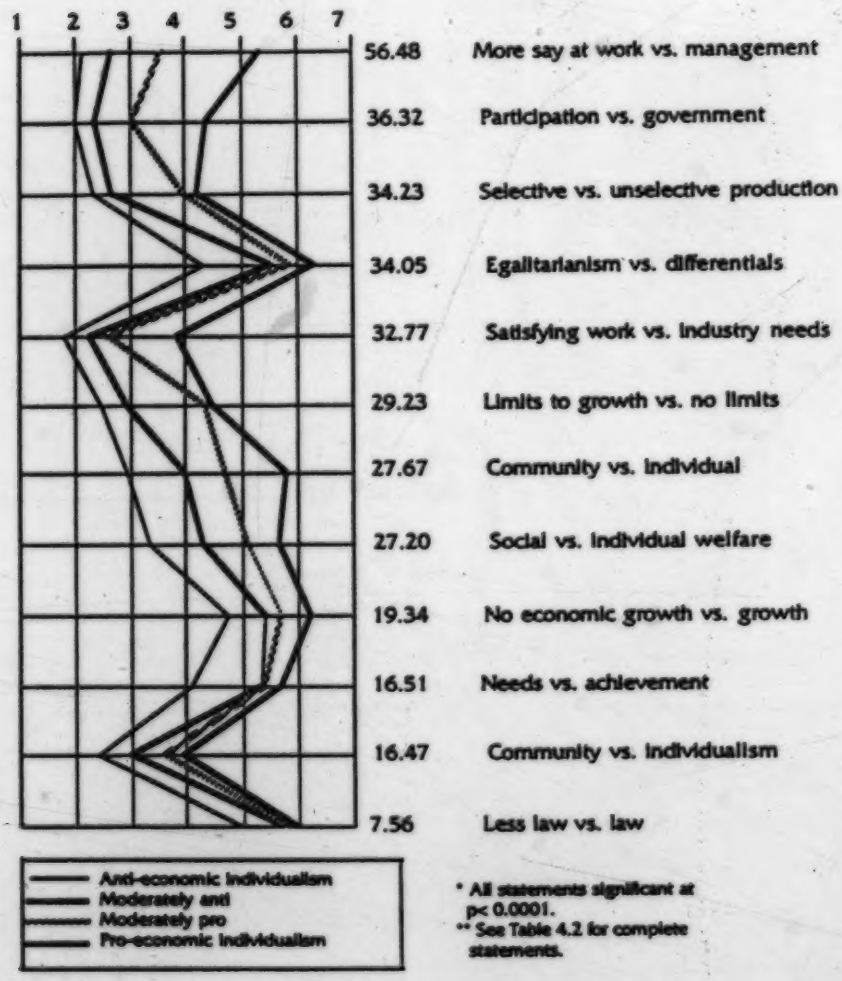
Orientation	Scale Score Range	N	%
Anti-economic individualism	24-41	52	13.4
Moderately anti	42-49	138	35.7
Moderately pro	50-57	133	34.4
Pro-economic individualism	58-74	64	16.5
Total		387	100.0

To test the validity of the above taxonomy, an analysis of variance test was undertaken between each groups' responses to the twelve social alternatives. The mean scores varied consistently and significantly in the expected direction; those opposed to economic individualism had the lowest mean scores and those supporting economic individualism had the highest (Figure 7.1).

7.3 Societal Values and Factors of Environmental Attitudes

According to Cotgrove (1982), two main conclusions have emerged from recent research into the social basis of environmental concern. First, that it is "important to distinguish between different components of environmental concern, and secondly, that cognitive variables are probably as important as socio-demographic variables in predicting

FIGURE 7.1
SOCIETAL VALUES SCALE: MEAN SCORES


MEAN SCORES
F*
STATEMENTS**
1 2 3 4 5 6 7
56.48 More say at work vs. management
36.32 Participation vs. government
34.23 Selective vs. unselective production
34.05 Egalitarianism vs. differentials
32.77 Satisfying work vs. industry needs
29.23 Limits to growth vs. no limits
27.67 Community vs. individual
27.20 Social vs. individual welfare
19.34 No economic growth vs. growth
16.51 Needs vs. achievement
16.47 Community vs. individualism
7.56 Less law vs. law
Anti-economic individualism
Moderately anti
Moderately pro
Pro-economic individualism

* All statements significant at $p < 0.0001$.
** See Table 4.2 for complete statements.

environmental concern" (1982, p. 132). The components of environmental concern have been established earlier through factor analysis (see Chapter 6.2). Four factors were found: 1) the consequences of growth and technology; 2) man-environment relationships; 3) quality of life; and 4) limits to the biosphere.

The four environmental factors, the entire attitude scale, the societal values scale, and the socio-economic variables were analyzed collectively in order to validate Cotgrove's second observation, namely that cognitive variables are as important as socio-economic variables in predicting environmental concern. Pearson's correlation coefficient and significance levels were computed to determine the degree of interconnection between variables (Table 7.2). The four environmental factors intercorrelated highly amongst themselves and with the entire attitude scale. What was noteworthy was that the societal values variable correlated more highly with the environmental scale and with each of the four factors than did any of the socio-economic variables. In other words, and in agreement with Cotgrove (1982), variations in environmental attitude orientation and concern were more a matter of support for certain values and beliefs than they were a product of particular social groups.

Table 7.3 gives the standardized coefficients for each of the four environmental attitude factors regressed step-wise against the societal values and the socio-economic variables. The results presented in the table allow for an assessment to be made of the relative independent contribution of the predictor variables (i.e. the societal values, socio-economic variables) to the variation in each of the four factors in the environment attitude scale. The value of R-squared gives the proportion of total variance explained.

Two conclusions can be drawn based on the results of the regression analysis. First, societal values had a substantial effect on all of the attitude scale factors. In fact, these variables accounted for most of the variation in reponses in each attitudinal factor. In each case, respondents with high scores on the societal values scale (i.e. "pro-economic individualists") also had high scores on each attitudinal factor (i.e. technocentrists).

TABLE 7.2
PEARSON CORRELATION COEFFICIENTS: ENVIRONMENTAL ATTITUDES, SOCIETAL VALUES, AND SOCIO-ECONOMIC CHARACTERISTICS

	Sex	Age	Educ.	Income	Societal Values	Fact 1[1]	Fact 2[2]	Fact 3[3]	Fact 4[4]	Total Scale
Sex	—									
Age	-.125 (.006)	—								
Educ.	-.138 (.003)	-.177 (.0001)	—							
Income	-.238 (.0001)	-.079 N.S.	.307 (.0001)	—						
Societal Values	-.189 (.0001)	.017 N.S.	-.044 N.S.	.158 (.001)	—					
Fact 1	-.219 (.0001)	-.163 (.001)	.183 (.0001)	.244 (.0001)	.440 (.0001)	—				
Fact 2	-.089 (.03)	.092 (0.3)	.128 (.006)	.149 (.002)	.382 (.0001)	.494 (.0001)	—			
Fact 3	-.047 N.S.	.111 (0.1)	-.192 (.0001)	-.018 N.S.	.332 (.0001)	.285 (.0001)	.252 (.0001)	—		
Fact 4	-.043 N.S.	-.04 N.S.	-.056 N.S.	.066 N.S.	.304 (.0001)	.430 (.0001)	.294 (.0001)	.332 (.0001)	—	
Total Scale	-.182 (.0001)	-.028 N.S.	.073 N.S.	.201 (.0001)	.523 (.0001)	.843 (.0001)	.724 (.0001)	.605 (.0001)	.651 (.0001)	—

[1]Consequences of growth and technology
[2]Man-environment relationhips
[3]Quality of life
[4]Limits to the biosphere

TABLE 7.3
MULTIPLE REGRESSION ANALYSIS OF ENVIRONMENTAL ATTITUDE FACTORS

Independent Variable	Dependent Variable: Growth and Technology	Man and Nature	Quality of Life	Limits to the Biosphere
Societal values	0.396	0.364	0.319	0.271
Sex	-0.121	0.018	0.018	0.001
Age	-0.161	0.112	0.064	-0.073
Education	0.133	0.145	-0.148	-0.073
Income	0.115	0.093	-0.013	0.048
R^2	0.276	0.178	0.135	0.090

Second, the socio-economic variables had only a minor influence on three of the four factors. Growth and Technology (Factor 1), was influenced by all four socio-economic variables; younger males with above average education and income were more supportive of continued expansion along what can be termed "technocentric" lines. Only age and education, however, had any influence on Factor 2 (Man and Nature); older and more educated respondents did not express as much concern as the remaining respondents about mankind's attempts to "dominate" nature as they supported a more utilitarian perspective of man-environment relationships. Education was inversely related to the Quality of Life factor (Factor 3); respondents with lower levels of formal education tended to be more technocentrically oriented. In general, however, the socio-economic variables did not account for much of the variation in the attitudinal factors. The respondents' societal values proved to be the strongest and most reliable predictors of environmental attitudes.

7.4 Societal Values and Environmental Attitudes

To determine more precisely the relationship between environmental attitudes and societal values, crosstabulation analysis was undertaken between the four major categories of respondents on each measure. A strong and statistically significant relationship was found (Table 7.4). Over three-quarters of the ecocentrists were opposed to economic individualism (societal values scale categories 1 and 2) while over four-fifths of the technocentrists supported this position (categories 3 and 4). Specific statements incorporated in the societal

values scale can now be examined with respect to the respondents' environmental orientation.

TABLE 7.4
ENVIRONMENTAL ATTITUDES AND SOCIETAL VALUES

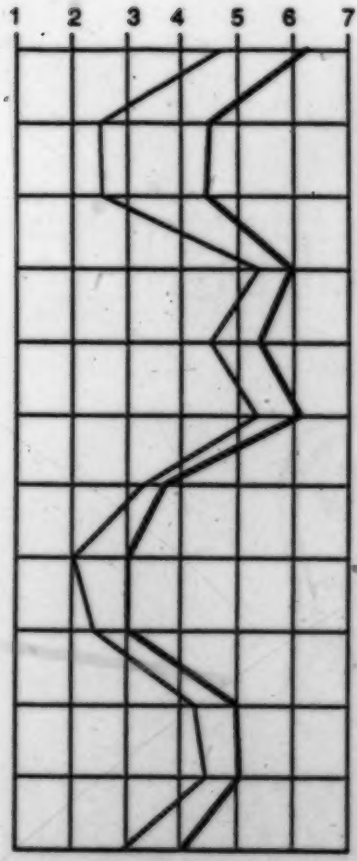
Societal Values	Environmental Orientation			
	Ecocentric			Technocentric
	1 %	2 %	3 %	4 %
Anti-economic	35.3	15.4	7.3	1.6
Moderately anti	41.2	47.6	30.9	14.5
Moderately pro	19.6	29.4	41.5	43.5
Pro-economic	3.9	7.7	20.3	40.3
Total (n)	(50)	(136)	(130)	(63)

Chi-square = 84.87; d.f. = 9; $p < 0.0001$

The results from an analysis of variance conducted to establish which statements discriminated best between ecocentrists and technocentrists are presented in Figure 7.2. The societal value statements are grouped in a manner similar to those found in Cotgrove (1982, p. 30) and outlined earlier. The greatest divergence between ecocentrists and technocentrists centred around the issues related to wealth creation and limits to growth. Ecocentrists were less supportive of economic growth, unselective industrial production, and overcoming the "limits to growth" than were technocentrists.

The three statements in the "authority versus participation" section of the societal values scale were also statistically associated with the respondents' environmental attitudes although not as strongly as the alternatives discussed above. Ecocentrists and technocentrists differed the most with respect to the employee-industry relationship alternative. Ecocentrists were more strongly in favour of a society in which work would be "humanly satisfying" as opposed to being determined and controlled solely in relation to the needs of industry, a position more strongly supported by technocentrists. Having more say at work and increased participation in the decision making process were also considered more important to ecocentrists than to technocentrists. With respect to the latter two statements, however, the mean scores of the two extreme attitudinal groups, although statistically significant, were below the median, 4.00. In other words, agreement in principle is evident amongst the

FIGURE 7.2
ENVIRONMENTAL ATTITUDES AND SOCIETAL VALUES



F	P <	Statements*
21.68	0.0001	No economic growth vs. growth[1]
22.17	0.0001	Selective vs. unselective production[1]
11.86	0.0001	Limits vs. no limits[1]
2.38	N.S.	Less law vs. law[2]
6.07	0.0005	Needs vs. achievements[2]
8.08	0.0001	Egalitarian vs. differentials[2]
3.35	0.05	More say vs. management[3]
10.40	0.0001	Satisfy vs. needs of industry[3]
3.65	0.05	Participation vs. government[3]
2.55	N.S.	Community vs. individual[4]
1.51	N.S.	Social vs. individual welfare[4]
7.11	0.0001	Community vs. individualism[4]

Ecocentric
Technocentric

* See Table 4.2 for complete statements.

1 Limits to growth vs. wealth creation
2 Participation vs. authority
3 Non-market vs. market
4 Collective vs. individual

attitudinal groups; the differences between them are in terms of the degree of support attributable to these values.

The above conclusion also applies to the remaining two categories of statements on the societal values scale (i.e. market vs. nonmarket; individual vs. collective good). Although some statistically significant relationships were found between the societal values statements and environmental attitudes, the mean scores on each statement expressed by the extreme attitude groups were, with one exception, above the mean.

In summary, ecocentrists and technocentrists were generally in agreement about the type of society they would like to see in terms of the emphasis given to the role of the individual, the community, and industry and the government. Although the different emphasis given to most of the statements representing these categories did not exhibit marked discrepancies between the extreme attitude groups, technocentrists had in each case higher mean scores than did the ecocentrists.

The major area of disagreement between the two groups was related to wealth creation and the environment. Ecocentrists consistently held values sympathetic to selective industrial expansion (e.g. towards products which use little energy), to resource conservation and wise resource management (e.g. recognizing the limits to growth), and to a society less geared towards ever-increasing economic growth. Technocentrists, on the other hand, held values that are generally consistent with those of the *status quo* and, as a result, were at odds with those supported by the ecocentric portion of the sample.

The results outlined above are consistent with those presented earlier in this chapter whereby the societal values of the respondents were found to be good predictors of environmental orientation and concern. This was true of all four factors in the environmental attitude scale but particularly so with respect to Factor 1 (The consequences of growth and technology). It was around these issues that the most divergence between ecocentrists and technocentrists was found and which explained (predicted) the greatest variation in attitudinal orientation generally.

7.5 Values and Energy

The way society thinks about energy affects the way society makes decisions about energy (Stern and Aronson, 1984). Energy may have many different meanings in modern society. Indeed, there is no single socially shared concept of energy, and each concept has different implications for the way society produces, controls, allocates, and uses energy. According to Stern and Aronson (1984, pp. 15-20), there are at least four views of energy widely held in western society: 1) a commodity; 2) an ecological resource; 3) a social necessity; and 4) a strategic material. Each view encompasses certain values. The domination of one view, however, does not occur to the exclusion of values associated with an opposing view. Rather, the values associated with the most pervasive view take precedence over all others.

The central values of the commodity view of energy include the provision of choice to buyers and sellers of energy through emphasis on the mechanisms of a free market economy (i.e. supply and demand). Sustainability, frugality, and the reduction of environmental impacts are dominant characteristics of the ecological view. Ensuring that energy is available to all members of society (i.e. equity) is central to the social necessity view, while the availability of energy for national security (economic and strategic) characterizes the strategic view.

On the basis of the above review, a series of seven statements was formulated to determine which views of energy respondents most supported. Specifically, they were asked to rate seven objectives in terms of each one's importance to the development of a strategy for energy development and use. Each of the four views of energy outlined above was represented by at least one statement.

All seven objectives were rated highly (i.e. between "somewhat" and "very" important). Indeed, the lowest mean score for any objective was 3.24 out of a possible 4.00. Respondents were also asked to indicate which objectives they considered to be the most and second most important and therefore a relative hierarchy of energy policy objectives could be determined (Table 7.5). Meeting the essential needs of all members of society, ensuring that

sustainable supplies of energy would be available for the long term, and minimizing pollution and environmental damage were rated the most frequently as the most important objectives. Economic security was rated as the most important by about 10% of the respondents while energy efficiency, job creation, and reduced prices all received less than 10% support.

TABLE 7.5
MOST IMPORTANT ENERGY POLICY OBJECTIVES

Objectives	Most Important		Most Important and Second Most Important Combined	
	N	%	N	%
Meet essential needs	111	27.7	173	21.7
Sustainable supplies	78	19.8	169	21.2
Minimize pollution	67	16.7	159	19.9
Economic security	43	10.7	77	9.7
Energy efficiency	37	9.2	78	9.8
Create jobs	36	9.0	77	9.7
Keep costs down	29	7.2	64	8.0
Total	401	100.0	797	100.0

When the energy policy objectives were examined in terms of the combined most and second most important, the relative order remained the same. In fact, the three objectives of meeting the essential needs of all members of society, ensuring that sustainable supplies of energy are available, and minimizing pollution were considered the most or second most important by 62.8% of all respondents. Almost the same proportion of respondents rated these objectives as the most important (64.2%). The remaining objectives were each rated as the most or second most important by less than 10% of the sample.

7.6 Energy Values and Environmental Attitudes

Crosstabulation analysis was conducted to determine if a relationship was evident between respondents' environmental attitudes and the energy policy objective they rated as the most important. An association between the ecocentric worldview and the environmentally oriented objectives (i.e. minimize pollution, energy efficiency) was expected. Technocentrists were expected to endorse more strongly the commodity view of energy (i.e. keep costs down, create jobs). This indeed proved to be the case (Table 7.6). While almost a third of the

ecocentrists (32.1%) felt that the most important objective of an energy policy should be to minimize pollution and environmental effects, less than 5.0% of the technocentrists concurred. Similarily, almost three times as many ecocentrists (17.0%) as technocentrists (6.3%) felt that energy efficiency was the most important objective. Collectively, this "ecological view" was rated by 49.1% of the ecocentrists as the most important compared to 10.9% of the technocentrists. Indeed, the more technocentrically inclined respondents were, the less they tended to emphasize the ecological view. Conversely, the two objectives associated with the commodity view were rated significantly higher by technocentrists than ecocentrists. Specifically, technocentrists were more likely to favour job creation (20.3%) and lower energy costs (10.9%) than were ecocentrists (3.8% and 5.7% respectively). Technocentrists were also more inclined to rate the objective of economic security (17.2%) higher than ecocentrists (5.7%).

Two objectives did not exhibit marked discrepancies of support between the two extreme attitudinal groups. Meeting the essential needs of all members of society (i.e. equity) had almost equal support from ecocentrists and technocentrists alike (22.6% and 26.6% respectively). The most support for this view of energy came from the moderate techocentrists (33.3%). Similarily, ensuring that sustainable supplies of energy are available over the long term was equally important to ecocentrists (13.2%) and technocentrists (14.1%). Again, the moderate technocentrists exhibited the most support.

7.7 Discussion

The results presented in this chapter have demonstrated that variations in environmental attitudes were more strongly associated with respondents' societal values than with their socio-economic characteristics. This was true for the entire attitude scale and each of the four factors that comprised the scale. It can therefore be concluded that variations in environmental attitudes were not the result of support by a particular socio-economic group, a conclusion also reached by Cotgrove (1982).

TABLE 7.6
ENVIRONMENTAL ATTITUDES AND MOST IMPORTANT ENERGY POLICY OBJECTIVES

Objectives	Environmental Orientation			
	Ecocentric			Technocentric
	1 %	2 %	3 %	4 %
Meet essential needs	22.6	24.0	33.3	26.6
Sustainable supplies	13.2	21.2	23.0	14.1
Minimize pollution	32.1	21.2	11.1	4.7
Economic security	5.7	8.9	12.7	17.2
Energy efficiency	17.0	12.3	3.2	6.3
Create jobs	3.8	7.5	7.9	20.3
Keep costs down	5.7	4.8	8.7	10.9
Total (n)	(53)	(146)	(126)	(64)

Chi-square = 52.16; d.f. = 18; $p < 0.0001$

Although a strong relationship was found between environmental attitudes and societal values generally, the greatest discrepancies between the two extreme attitudinal groups were found with respect to the issues related to the limits to growth and wealth creation; ecocentrists were strongly associated with the former, technocentrists with the latter. Despite the fact that a number of statistically significant relationships were uncovered between ecocentrists and technocentrists on the remaining three categories of social values (market vs. nonmarket; authority vs. participation; individual vs. collective), both attitudinal groups had mean scores consistently above or below the median. In other words, the differences were a matter of degree, not of kind.

The varying emphasis placed on the different views of energy, as measured by the importance attached to different policy objectives, also helps shed more light on the characteristics of the different attitudinal groups. Ecocentrists were more supportive of the ecological view of energy while technocentrists stressed the commodity and strategic (i.e. economic security) views. However, just as important as discovering the differences between the groups, it is important to discover points of similarity. In this case, a generally similar proportion of respondents felt that the equity view of energy (i.e. meeting essential needs) and the objective of long term security were the most important for developing an energy strategy. This substantiates a claim made earlier in this chapter with respect to the

respondents' societal values. The values which discriminated the least between the attitude groups were those relating to the individual versus the collective good. Alternatively, the areas of greatest divergence were found with respect to the issues of economic growth and environmental protection, a dichotomy reflected in both the measures of societal values and energy policy objectives.

8. ENERGY CONSERVATION

8.1 Introduction

In general, respondents to the questionnaire were supportive of energy conservation initiatives and have altered their behaviour in order to reduce energy consumption. However, differences were found between respondents in the different attitudinal categories with respect to the perceived effects of conservation and the number and type of conservation practices they had adopted. These issues will now be examined.

8.2 The Perceived Effects of Energy Conservation

A question asking respondents to indicate what they felt was the most important consequence arising from energy conservation measures was included. The results were crosstabulated with the environmental attitude categories established earlier (e.g. ecocentric, technocentric). As illustrated in Table 8.1, the issue of long term energy security ("More energy will be available for the future") was deemed as the most important consequence by over a third of the respondents in each attitudinal category. Substantial differences, however, were found between the attitudinal groups and the environmental impacts issue. Specifically, more than twice as many ecocentrists than technocentrists felt that there would be "less pollution and environmental damage" (46.2% versus 21.3% respectively). Technocentrists, on the other hand, more frequently cited the reduction of foreign oil imports (23.0%) and reduced energy prices (11.5%) than did ecocentrists (13.5% and 5.8% respectively).

These results are consistent with those presented earlier in terms of respondents' reasons for choosing various energy options. Security was important to a substantial percentage of all resondents while ecocentrists placed more emphasis on environmental effects and technocentrists stressed economic issues.

TABLE 8.1
ENVIRONMENTAL ATTITUDES AND PERCEIVED EFFECTS OF ENERGY CONSERVATION

Effects of Conservation	Environmental Orientation			
	Ecocentric			Technocentric
	1 %	2 %	3 %	4 %
More energy available	34.6	44.2	55.3	44.3
Less pollution	46.2	34.1	22.8	21.3
Foreign oil imports reduced	13.5	13.0	15.4	23.0
Energy prices reduced	5.8	8.7	6.5	11.5
Total (n)	(52)	(138)	(123)	(61)

Chi-square = 17.35; d.f. = 9; $p < 0.004$

8.3 Adoption of Energy Conservation Practices

Two questions were included in the questionnaire to elicit information about which (if any) energy conservation practices respondents had adopted. The first asked if any efforts had been made to reduce energy consumption. Just over 85% of the respondents indicated that they had adopted some measures. There were no statistical differences, however, between environmental orientation and adoption of conservation practices (Table 8.2). Indeed, the majority of respondents in each attitude category stated that they had made efforts to curtail energy consumption.

TABLE 8.2
ENVIRONMENTAL ATTITUDES AND ADOPTION OF ENERGY CONSERVATION PRACTICES

	Environmental Orientation			
	Ecocentric			Technocentric
	1 %	2 %	3 %	4 %
Have adopted	90.4	81.8	85.6	85.7
Have not adopted	9.6	18.2	14.4	14.3
Total (n)	(52)	(137)	(125)	(63)

Chi-square = 2.36; d.f. = 3; (N.S.)

Respondents replying to the above question in the affirmative were requested to list the energy conservation practices they had adopted. In total, forty-nine different practices were listed. No respondent included more than nine items. Turning down the thermostat (47.0%), turning off lights (41.0%), increasing insulation (39.3%), and purchasing or using a smaller fuel-efficient vehicle (29.6%) were the most frequently cited measures (Table 8.3).

To determine if an association between environmental attitudes and the range of conservation practices adopted was apparent, the conservation measures were collapsed into four groups: (1) did not adopt; (2) adopted 1-2 practices; (3) adopted 3-4 practices; and (4) adopted 5-9 practices. In this way, crosstabulation could be undertaken to determine the intensity of adoption between the four attitude groups.

Significant differences were found (Table 8.4). More than three times as many technocentrists than ecocentrists listed one or two practices (34.4% versus 13.3%). Ecocentrists, on the other hand, adopted significantly more conservation measures. Specifically, 43.4% of the ecocentrists adopted three or four measures compared to 35.9% of the technocentrists. Of more importance, however, was the greater proportion of ecocentrists (34.0%) than technocentrists (12.5%) who adopted between five and nine measures. Combining these latter two categories, over three-quarters of the ecocentrists claimed to have adopted between three and nine conservation measures compared to less than half of the technocentrists.

TABLE 8.3
FREQUENCY OF SPECIFIC ENERGY CONSERVATION PRACTICES

Energy Conservation Practice	Totals (N)	%
Turn thermostat down	189	47.0
Turn off lights	165	41.0
Increase insulation	158	39.3
Purchase/use small car	119	29.6
Use public transportation	46	11.4
Walk more	38	9.5
Efficient use of appliances	35	8.7
Conscious water use	34	8.5
Drive less	31	7.7
Install thermostat device	29	7.2
Buy energy efficient products	28	7.0
Install weatherstripping	27	6.7
Caulk windows and doors	27	6.7
Bicycle	26	6.5
Maintain vehicle	25	6.2
Conscious electricity and gas use	24	6.0
Use less hot water	22	5.5
Carpool	20	5.0
Install storm doors or windows	19	4.7
Drive slower	18	4.5
Maintain furnace	15	3.7
Use microwave oven	15	3.7
Recycle materials	14	3.5
Wear more clothing	13	3.2
Promote energy conservation	13	3.2
Use fireplace	12	3.0
Combine shopping trips	11	2.7
Use cold water to wash clothes	10	2.5
Window glazing	10	2.5
Purchase efficient furnace	8	2.0
Use plug-in timer for block heater	7	1.7
Travel less	6	1.5
Retrofit house	6	1.5
Use clothesline	6	1.5
Home improvements	6	1.5
Heat with wood	5	1.2
Convert car to propane	5	1.2
Install fireplace insert	4	1.0
Purchase durable products	4	1.0
Install solar panels	4	1.0
Use unleaded fuel	3	0.7
Close drapes	3	0.7
Heat specific rooms	3	0.7
Turn off appliances	2	0.5
Use motorcycle	2	0.5
Install ceiling fan	2	0.5
Use/consume less	1	0.2
Garden	1	0.2
Simple lifestyle	1	0.2

TABLE 8.4
ENVIRONMENTAL ATTITUDES AND NUMBER OF CONSERVATION PRACTICES ADOPTED

Conservation Practices	Environmental Orientation			
	Ecocentric			Technocentric
	1 %	2 %	3 %	4 %
Did not adopt	11.3	21.2	15.7	17.2
Adopted 1-2 practices	11.3	8.2	23.6	34.4
Adopted 3-4 practices	43.4	41.1	41.7	35.9
Adopted 5-9 practices	34.0	29.5	18.9	12.5
Total (n)	(53)	(146)	(127)	(64)

Chi-square = 28.31; d.f. = 9; $p < 0.001$

The results presented above lend support to the contention that an association between respondents' environmental orientation and their adoption of energy conservation is evident. Specifically, the more ecocentrically-inclined respondents were, the greater the likelihood that they would adopt more conservation practices. However, it has also be demonstrated that environmental attitudes did not influence to any great extent the basic level of adopting or not adopting conservation measures. Rather, environmental attitudes were strongly associated with respondents' propensity to adopt a *range* of behaviours.

8.4 Categories of Energy Conservation

The forty-nine energy conservation practices originally listed by the respondents were collapsed into seven categories to permit further analysis (Table 8.5). Three criteria were used to group the behaviours. Specifically, practices were combined on the basis of:

1. The similarity between conservation practices;
2. Practices which involved on-going behavioural change; and
3. Practices which involved a one-time purchase or activity.

TABLE 8.5
CLASSIFICATION OF ENERGY CONSERVATION BEHAVIOURS

Category	Specific Examples
1. Reduction of energy use in the home (behavioural)	Turning down thermostat; maintaining the furnace; wear more clothing; heat specific rooms; close drapes
2. Efficient use of water	Wash clothes in cold water; use less water for baths; shower; use less hot water
3. Efficient Use of Gas and Electricity	Turn off lights; turn off appliances; use applicances more efficiently; maintain appliances; use stove less; reduce gas consumption; use microwave
4. Consumer purchases/lifestyle	Buy energy efficient appliances; recycle materials; use/consume less; garden; buy durable products; promote conservation; simple lifestyle
5. Heat loss prevention (structural)	Increase insulation; install weatherstripping; thermostat device; fireplace insert; storm doors and windows; window glazing; caulking; ceiling fan; solar panels; home improvements
6. Use and type of vehicle	Purchase/use small car; drive slower; maintain vehicle; drive less; travel less; convert car to propane; use energy efficient plug-in
7. Alternative transportation	Use public transportation; bicycle; walk more; motorcycle

The first criterion was applied to all of the conservation practices. Distinctions were made, for example, between practices done in the home versus those related to transportation. Further divisions were then made in terms of the specific practices involved (e.g. home heating behaviour versus efficient water use). The rationale for the second and third criteria was that differences may be found between practices which involve a permanent change in the respondents' behavioural pattern (e.g. turning down the thermostat at night) as opposed to

those which involved a one-time activity or purchase without the implication of any on-going behavioural commitment. Categories 1, 2, 3, 4, and 7 comprised the former category, while categories 5 and 6 were included in the latter.

It should be pointed out that for two of the conservation categories, the second and third criteria were not as clear-cut as in the remaining categories. For example, practices in Category 4 (Consumer purchases/lifestyles) were classified as requiring on-going behavioural change even though some of the practices involved a one-time purchase. They were included in this category because the implication that buying energy efficient or durable products was an important component of respondents' overall shopping behaviour. Category 6 (Use and type of vehicle) was comprised of a mix of behavioural and one-time purchase measures. However, as the majority of the respondents in this category were included because they had purchased a smaller car, the category itself may be considered as at least partially fulfilling the requirements of the third criterion. It should be kept in mind, however, the categorization of this latter group is not rigorous.

The frequency of adoption of the various types of conservation measures is presented in Table 8.6. Respondents were classified on the basis of adopting or not adopting one of the practices within each category. Almost half of the respondents claimed to have adopted at least one practice in four of the seven categories (home heating behaviour, use and type of vehicle, heat loss prevention, and efficient gas or electricity use). Practices in the alternative transportation (25.9%), purchases/lifestyles (16.2%), and water conservation (15.4%) categories received the lowest rates of adoption.

TABLE 8.6
ADOPTION OF CONSERVATION PRACTICES BY CATEGORY

Conservation Practice	N	%	Rank
Home heating behaviour	203	50.5	1
Use and type of vehicle	197	49.0	2
Heat loss prevention	195	48.5	3
Gas/electricity use	186	46.8	4
Alternative transportation	104	25.9	5
Purchase/lifestyle	65	16.2	6
Water conservation	62	15.4	7

8.5 Environmental Attitudes and Conservation Behaviour

8.5.1 Crosstabulation

A series of crosstabulations was undertaken between respondents' environmental attitudes and their stated adoption of conservation practices by type. It was expected that there would be an inverse relationship between environmental orientation and respondents' adoption of specific conservation measures. As shown in Table 8.7, this proved to be the case for four of the seven conservation categories. For example, 71.7% of ecocentrists compared to 34.4% of technocentrists adopted measures to reduce energy use in the home. Similarly, more ecocentrists than technocentrists used gas and electricity more efficiently (64.2% versus 40.6%). This trend was also evident for practices related to purchases and lifestyles and alternative transportation.

TABLE 8.7
ENVIRONMENTAL ATTITUDES AND ADOPTION OF CONSERVATION PRACTICES BY CATEGORY[1]

Adoption	Ecocentric 1 %	2 %	Technocentric 3 %	4 %	X^2	P<
Reduce home energy use	71.7	51.4	48.0	34.4	16.53	.0009
Efficient water use	13.2	17.8	9.4	23.4	7.48	N.S.
Efficient gas/electricity use	64.2	45.2	44.1	40.6	7.91	.04
Purchase/lifestyles	22.6	21.2	8.7	14.1	9.90	.01
Heat loss prevention	41.5	44.5	53.4	51.6	3.93	N.S.
Use and type of vehicle	49.1	49.3	46.5	54.7	1.15	N.S.
Alternative transportation	37.7	30.8	22.0	15.6	10.03	.01

[1]Degrees of freedom = 3 in all cases

No statistically significant differences were found for three of the categories, namely efficient water use, heat loss prevention, and use and type of vehicle. It was noteworthy that two of these categories (5 and 6) involved one-time purchases or activities and that the four categories that were statistically associated with environmental attitudes involved on-going behavioural commitments. Based solely on these findings, it can be inferred that the more

ecocentrically inclined respondents were, the more committed they were to conserving energy, particularily if the practices involved long term behavioural adjustments. An alternative explanation may be that respondents' socio-economic status may necessitate that they adopt certain practices, or if they did not adopt certain practices, their relative status may forbid it. This issue will now be examined.

8.5.2 Zero Order and Partial Correlation

In order to establish if environmental attitudes and respondents socio-economic characteristics had a direct effect on their stated adoption of conservation behaviours, zero order and partial correlations were undertaken. Zero order correlations were used to analyze the direct relationships between attitudes and behaviours, while in the partial correlations, potential socio-economic influences were controlled (Table 8.8). A negative relationship between the adoption of conservation measures and environmental attitudes was expected.

With respect to the total number of practices adopted, the attitude scale (zero order coefficient = -0.15) proved to be the most appropriate variable for explaining variations in the level of adoption. The partial coefficient(-0.14) was only marginally lower than the zero order coefficient when socio-economic variations were controlled. Thus, the environmental attitude scale proved to be a better predictor of respondents' energy conservation behaviours than were the socio-economic variables.

As was the case with the crosstabulation analysis, respondents' environmental orientation was the most appropriate variable for explaining variations in adopting four of the seven categories of conservation behaviours. These included reduced home energy use (zero order coefficient = -0.18), efficient gas/electricity use (-0.21), purchases/lifestyle (-0.15), and alternative transportation (-0.20). These four categories all represented those which involved on-going behavioural adjustments. For the remaining conservation practices, the respondents' socio-economic characteristics explained significantly more variation. Females with lower levels of formal education claimed more frequently to have adopted practices in the "efficient water use" category.

TABLE 8.8
ZERO ORDER AND PARTIAL CORRELATIONS BETWEEN ADOPTION OF CONSERVATION PRACTICES, ENVIRONMENTAL ATTITUDES AND SOCIO-ECONOMIC VARIABLES

Conservation Practices	Attitude Scale		Sex	Age	Education	Income
	Zero Order	Partial[1]				
Total adoption	-.15	-.14	.08	-.13	.13	.04
P<	.002	.004	N.S.	.006	.006	N.S.
Reduced home energy use	-.18	-.17	.12	-.10	-.02	-.02
P<	.0001	.0001	.009	.02	N.S.	N.S.
Efficient use of water	.04	.06	.13	-.04	-.11	.01
P<	N.S.	N.S.	.005	N.S.	.01	N.S.
Efficient gas/electricity use	-.21	-.16	.09	.05	-.05	-.14
P<	.0001	.0001	.02	N.S.	N.S.	N.S.
Purchases/lifestyle	-.15	-.13	.03	-.08	.11	-.05
P<	.002	.004	N.S.	N.S.	.01	N.S.
Heat loss prevention	.02	.02	-.12	.08	.13	.21
P<	N.S.	N.S.	.008	.04	.005	.0001
Use and type of vehicle	.07	-.04	-.15	-.06	.15	.12
P<	N.S.	N.S.	.002	N.S.	.002	.009
Alternative transportation	-.20	-.17	.13	-.16	.05	-.09
P<	.0001	.0001	.006	.001	N.S.	N.S

[1]Partial correlation, controlling for sex, age, education and income.

All four socio-economic variables helped account for the variance in the adoption of heat loss prevention measures. Specifically, older males with more formal education and income claimed to have adopted more of these practices than their counterparts. More formally educated males with above average income also more frequently cited the options related to the use and type of vehicle.

8.6 Discussion

The results presented in this chapter support the contention that energy conservation has been widely accepted and practised by the respondents. Furthermore, a link between environmental attitudes and the adoption of a range of conservation measures and specific types of practices has been established. The main findings will be briefly reviewed.

It was found that environmental attitudes were not statistically associated with the basic level of adoption of conservation practices. The vast majority of respondents in each attitudinal category claimed to have made efforts to reduce the amount of energy that they used. Turning down the thermostat, turning off lights, increasing insulation, and purchasing or using a smaller vehicle were the most frequently mentioned conservation practices. Significant differences, however, were found with respect to the number of conservation measures adopted and environmental attitudes. More than three-quarters of the ecocentrists claimed to have adopted between three and nine practices compared to less than half of the technocentrists.

Respondents' environmental attitudes were also related to their propensity to adopt specific categories of conservation measures, particularly those which involved on-going behavioural commitments (e.g. home heating behaviour, efficient gas/electricity use). Evidence to support this contention was found both through crosstabulation analysis and zero order and partial correlation. Conservation practices that involved a one-time purchase or activity (e.g. use and type of vehicle) were found to be more strongly associated with the respondents' socio-economic characteristics (mainly sex, education, and income). In these cases, males with above average education and income claimed greater rates of adoption than

did their counterparts. Environmental attitudes had no apparent influence.

The data presented in this chapter suggest that a relationship between environmental attitudes and behaviours is defensible on the basis of social science research. Positive results have been found and are strong enough to indicate that some causal relationships are involved. However, they are not strong enough to suggest that attitudinal responses can serve as mechanical substitutes for behavioural responses. In other words, attitudes do not always translate into behaviours. It is reasonable to suppose, however, that attitudes will affect behaviour unless action is constrained by other influences. For example, ecocentric attitudes may provide an impetus for action, but some actions are easier to accomplish than others because of limitations on behaviour imposed from the environment (physical and social). People may be prevented from acting on their attitudes because decisions have been made for them by intermediaries, because they do not have the right to act (e.g. insulating the walls of a rented apartment unit), because they cannot afford some actions, or for myriad other reasons. Thus, attitudes are more influential with respect to some behaviours than others.

9. CONCLUSIONS

9.1 Summary

A central argument advanced in this thesis is that perceptions of and preferences for energy resource options and energy development strategies are inextricably related to fundamental attitudes and values about the environment and society generally. Using the concept of environmental paradigms or world views, an analysis of four energy development scenarios (forecasts and backcasts) was undertaken to determine the extent to which each one corresponded to the major tenets of either the Dominant Social Paradigm (DSP) or New Environmental Paradigm (NEP). The energy options proposed by each forecasting agency to replace conventional oil and ensure against future energy shortages were outlined, as were the major assumptions and objectives contained in each forecast or backcast.

A similar analysis was undertaken based on a public sample of residents from Calgary and Edmonton. Energy preferences and the reasons for preferring specific energy options were measured. Public commitment to either the DSP or NEP was established and associations between these "world views" and energy preferences and the reasons for choice were sought. Societal values, energy policy objectives, and reported energy conservation practices were also examined with reference to environmental attitudes.

The analysis of energy development scenarios provides a "context" or perspective within which public attitudes, perceptions, and preferences can be viewed. Furthermore, by examining the scenarios and the public within a similar conceptual framework, and uncovering components of energy decision-making common to both (i.e. attitudes, rationale, preferences), comparisons can be made with the assurance of a relatively strong degree of reliability.

The main findings from the review and analysis of the energy forecasts (Economic Council of Canada, ECC; Energy Resources Conservation Board, ERCB) and backcasts (Friends of the Earth, FOE; Alberta Environment Network, AEN) will be outlined initially, followed by a review of the main results of the questionnaire survey. A synthesis of the two

major sections will then be undertaken and suggestions for future research will then be advanced.

On the basis of the review of four energy development scenarios, the following conclusions have been reached:

1. *In general, both the ECC and the ERCB reports represent energy futures which stress the economic and supply side of energy and are aligned with the status quo in terms of institutional arrangements and energy supplies.*

   For the ECC, energy policy is directed towards the achievement of long term economic growth and stability based on the underpinnings of the present energy supply system. By assuming that current government policies would continue to be in effect throughout their forecast period (1986-2010), the ERCB has also adopted a similar position.

2. *In general, both the FOE and AEN scenarios stress the demand side of energy and the incorporation of environmental constraints into the selection of energy alternatives.*

   In both reports, a number of energy supply alternatives are rejected on the basis of their assumed deleterious environmental consequences (e.g. nuclear power, Arctic oil). Substantial reductions in energy demand are also assumed to be made in all sectors of the economy without adversely affecting economic growth or employment opportunities.

3. *The transformation from dependence on conventional crude oil is recognized in all four energy scenarios, but alternative strategies are proposed by the different agencies.*

   Although a transition is acknowledged as inevitable in each energy scenario, di[illegible] between the studies are evident with respect to the proposals advanced to replace conventional oil. Essentially two strategies are proposed. The first, represented by the ECC and ERCB, outlines a strategy which is basically a "sequel" to the present energy supply system. Continued dependence on nonrenewable energy resources is advocated (e.g. coal, nuclear, conventional and frontier oil and gas) while the use of renewable energy resources (with the exception of hydro) remains limited.

   The second strategy, advanced by FOE and AEN, is based in all essentials on renewable energy resources and substantial reductions in energy demand. Biomass use is

expected to increase and eventually become a dominant energy source in the upcoming century. Nonrenewable energy resources (with the exception of nuclear power and Arctic oil and gas) will continue to be important in the short and medium term until their use is phased out during the first quarter of the twenty-first century.

4. *Although none of the energy scenarios can be said to represent the extreme views of either the DSP or NEP, the major characteristics of the scenarios are consistent with the attributes of the alternative world views.*

The scenarios advanced by the ECC and ERCB reflect the major tenets of the DSP, particularly with regard to the emphasis given to economic growth, reliance on market forces to determine energy supply, the large scale and centralized nature of the energy system proposed, and the continued reliance on nonrenewable energy resources.

Alternatively, the energy futures outlined by FOE and AEN are generally consistent with the tenets of the NEP. Energy development is viewed as confronting and conforming to environmental constraints. Strong emphasis is given to decreasing energy use both to conserve resources and reduce pollution, energy is matched in scale and end use needs, and decentralized, small scale energy development initiatives are encouraged.

The alternative scenarios can be viewed as representing a debate between two different perceptions: a traditional penchant for economic and technological progress versus a more recent view of the world as finite in resources and limited in potential to support growth.

The major findings from the questionnaire survey are as follows:

1. *A substantial shift in energy preferences among the public was found between the short term ("the next five years") and the long term ("beyond the year 2000").*

While the majority of respondents most preferred nonrenewable resources in the short term (fossil fuels, nuclear power), renewable resources (solar and wind energy, hydro) and energy conservation were preferred by the majority in the long term. In fact, preferences for renewable options more than doubled between the two temporal periods. It can therefore be concluded that a transition away from the present dependence on

nonrenewable resources is acknowledged and favoured by the majority of the public.

The energy options least preferred by the public remained essentially the same in both time periods. Nuclear power was the least preferred option by over one-third of the respondents, followed by biomass and the fossil fuels (mainly coal). Solar and wind energy, energy conservation, and hydro were the least preferred options of only a small minority of the sample in both time periods.

2. ***With the exception of long term energy security, respondents preferring different categories of energy options expressed divergent reasons for their choices.***

Although long term energy security was deemed important by a substantial proportion of the sample, significant differences were found between respondents most preferring different energy options. Specifically, reasons relating to job creation and economic growth were more important to the respondents most preferring nonrenewable energy resources, while having fewer environmental impacts was associated with the proponents of renewable options. The latter reason, the perceived wastage of energy, and economic efficiency were associated with respondents most preferring conservation options.

No one reason predominated with respect to the respondents' least preferred energy options. Concern over long term energy security was particularly associated with those least preferring solar and wind energy as long term options. Having potentially serious environmental consequences was associated with respondents who least preferred the fossil fuels, nuclear power, and biomass, while being economically unrealistic was important to those least preferring fossil fuels, solar and wind, and biomass.

3. ***The ability of the environmental attitude scale to measure consistent dimensions of environmental attitudes has been demonstrated.***

A comparison of the results of factor analysis of the statements used in this study and by Jackson (1986) in a previous investigation revealed that twenty of the twenty-one statements loaded on the same factors. Four dimensions of environmental attitudes were found: the consequences of growth and technology; the quality of life; relationships between man and the environment; and limits to the biosphere. This result strongly

supports the contention that the attitude scales used in both investigations accurately reflect consistent dimensions of environmental concern among the public.

4. *Significant differences were found between the attitudinal categories and the energy options respondents most and least preferred.*

Initially respondents' scores on all twenty-one statements were combined and then subdivided based on the mean and standard deviation of the resultant distribution. Individuals with the lowest scores and hence the most pro-environmental were identified as ecocentrists, while those with the highest scores were described as technocentrists. This classification procedure was verified by means of cluster analysis; the results were almost identical to the taxonomy derived from the mean/standard deviation technique.

Respondents described as ecocentrists generally preferred renewable energy resources and energy conservation, and felt that nonrenewable options (nuclear power and the fossil fuels) should be emphasized the least. Conversely, respondents identified as technocentrists were more in favour of continued reliance on nonrenewable energy resources (mainly fossil fuels) and felt that renewable options (mainly biomass) should be emphasized the least. The results were consistent for both the short and the long term.

5. *With the exception of long term energy security, ecocentrists and technocentrists expressed divergent reasons for their choice of energy options.*

Ecocentrists overwhelmingly cited the reason related to the environment as the most important for their most and least preferred options. Technocentrists were more apt to cite economic-related reasons as the most important.

6. *Respondents' reasons for choice of their most and least preferred energy options were found to be consequences of their environmental attitudes and determinants of their energy preferences.*

The interrelationship among the variables was found to be both logically and statistically valid. It can therefore be stated that individuals with ecocentric attitudes are highly likely to prefer renewable energy resources and energy conservation measures *because* those

options are perceived to be environmentally less damaging, that they will reduce wasteful resource practices, and that their implementation would lead to the greatest level of energy security. Conversely, it is highly likely that individuals with technocentric attitudes will favour nonrenewable energy options *because* these options are perceived to lead to greater economic benefits as well as ensuring an energy secure future.

7. ***Variations in environmental attitudes were strongly associated with the respondents' societal values.***

   A series of twelve statements designed to find out about respondents' societal values was included in the questionnaire. Four categories of alternatives were represented: wealth creation versus limits to growth; market versus nonmarket; authority versus participation; and individual versus collective welfare. Based on a Pearson's correlation coefficient test and regression analysis, it was found that the societal values correlated highly with the environmental attitudes scale and with each of the four factors that comprised the scale. Specifically, technocentrists tended to support a "pro-economic individualist" position while ecocentrists were more supportive of an "anti-economic individualist" stance. It was also found that the greatest divergence between ecocentrists and technocentrists centred around the issues related to wealth creation and limits to growth. Ecocentrists were generally less supportive of economic growth, unselective production, and overcoming the "limits to growth" than were technocentrists. The respondents' socio-economic characteristics (sex, age, education, and income) were only weakly correlated with the environmental attitude scale.

8. ***The importance attached to energy policy objectives differred among the attitudinal groups.*** Ecocentrists emphasized the ecological aspects of energy development, while technocentrists emphasized the economic aspects. Ensuring that energy is available to all members of society and that sustainable supplies are available over the long term were highly rated by ecocentrists and technocentrists alike.

9. ***The vast majority of the sample (85%) claimed to have adopted at least one energy conservation practice.***

In response to an open-ended question, the vast majority of respondents listed at least one energy conservation measure they had adopted. In total, forty-nine different energy conservation practices were listed. Turning down the thermostat, turning off unnecessary lights, increasing insulation in the home, and purchasing or using a smaller vehicle were the most frequently cited measures.

10. *Ecocentrists adopted significantly more energy conservation practices than did technocentrists.*

Although environmental attitudes were not associated with the basic level of adopting, it was found that over one-third of the respondents identified as ecocentrists adopted between five and nine practices compared to less than 15% of the technocentrists. It can therefore be concluded that environmental attitudes were associated with respondents' propensity to adopt a *range* of conservation behaviours.

11. *Energy practices that involved ongoing behavioural committments were more strongly associated with environmental attitudes than were practices that involved a one-time activity or purchase.*

Conservation practices such as alterations in home heating behaviour, efficient gas and electricity use, and alternative transportation (e.g. mass transit, cycling) were adopted more frequently by ecocentrists than by technocentrists. The respondents' socio-economic characteristics were, however, more strongly associated with measures that involved one-time activities or purchases (e.g. structural adjustments in the home, purchase and use a smaller vehicle). Males with above average education and income adopted these practices more frequently than did the remainder of the sample.

9.2 Synthesis and Discussion

On the basis of the methodologies employed, the assumptions and objectives incorporated into the models, and the proposed direction of the transition from dependence on conventional oil, it can be maintained that the scenarios proposed by the ECC and ERCB are consistent with the major attributes of the DSP, while the energy futures advanced by

FOE and AEN are more closely aligned to the NEP. The "world views" held by each agency can therefore be viewed as important determinants of the objectives incorporated into the forecasting or backcasting models which in turn result in the projection of energy futures consistent with the objectives.

Among the public, this sequence was found to be statistically as well as logically valid. Respondents' reasons for choosing an energy option were found to be the consequences of their world views and determinants of their energy preferences. This relationship was consistent for both the most preferred energy options and the least preferred energy options. From this conclusion, it can be deduced that the same sequence was also valid with respect to the energy scenarios because the same "components" were isolated in each study, and the sequence itself is logical: attitudes lead to objectives, assumptions, and reasons, which in turn lead to preferences. As a result, the comparison of results from the energy scenarios and the public will more closely reflect the actual processes involved.

A transition away from the present dependence on nonrenewable energy resources is acknowledged both by the public and in the energy scenarios. However, a large proportion of the public favour a transition to increased reliance on renewable energy resources, particularly solar energy. None of the forecasting agencies projected a major role for solar energy by the turn of the century. The public seems to have a greater level of optimism about the potential of solar energy than is perhaps warranted at the present time.

Although the majority of the public favoured an energy future based on renewable resources and energy conservation, just over 40% felt that nonrenewable energy options should continue to be emphasized. In other words, unaminity among the public as to the direction the transition from conventional oil should take was not found. Thus, when the energy options are considered in these general terms, the dichotomy among the public is also reflected in the energy scenarios. Furthermore, the reasons cited by the sub-groups of the public which preferred the different energy resources were consistent with those expressed in the different energy forecasts. Supporters of nonrenewable energy options emphasized job creation and economic growth as did the ECC and the ERCB. Alternatively, concern over the environment

and wasteful energy practices was particularly associated with the supporters of renewable energy and energy conservation both among the public and by the authors of the FOE and AEN reports. Common to all the scenarios, and rated highly by a substantial proportion of the public regardless of their most preferred energy options, was ensuring that long term energy security could be attained.

When the energy options are considered in a more disaggregated form, some notable differences were found between the public's perception of energy options and those outlined in the energy scenarios, particularly among the respondents most preferring renewable resources. More than half of these respondents cited solar energy as the option to be emphasized the most and placed substantially less emphasis on hydro and biomass. Although the reasons cited to support these choices are similar to those advanced by FOE and AEN, the emphasis on solar rather than biomass as a major source of energy is at odds with the authors of the reports. In fact, biomass was rated by about one-quarter of the sample as their least preferred option and by less than 1% as their most preferred option. Concerns expressed over the environment, long term security, and economic viability prohibit its widespread acceptance which could prove to be a major obstacle to those organisations wishing to promote its use.

Respondents placed less emphasis on energy conservation in the long term than they did in the short term. The reasons cited to support their choice were consistent with the authors of the FOE and AEN reports. However, the emphasis on the short term may reflect the view that the public feels that conservation practices should be encouraged at present and in the near future, but in the long term, a high degree of energy efficiency will have been achieved and more emphasis can then be placed on developing alternative supply sources (mainly solar energy). It may also reflect the perception that energy conservation is a transitional measure on the way to an energy abundant future, but not a dependable long term strategy.

Respondents who most preferred nonrenewable options were more likely to cite a renewable resource (mainly biomass) as their least preferred option. Furthermore, the choice of energy option and the reasons emphasized for these choices were generally consistent with

those expressed by the ECC and the ERCB. The major discrepency between this portion of the public and the forecasting agencies was the varying emphasis given to nuclear power, which was favoured by the ECC but by less than 10% of the public. In fact, nuclear power was the least preferred option in both the short and long term mainly due to the perceived environmental consequences associated with its use.

A strong and consistent relationship was found between environmental attitudes and the energy preferences most and least preferred by the public. The results were comparable to those found in the energy scenarios. Ecocentrists generally preferred renewable resources and energy conservation and felt that nonrenewable resources should be emphasized the least, as did FOE and AEN. The main reasons expressed for these choices were those relating to the environment, energy wastage, and long term security. Conversely, technocentrists generally favoured nonrenewable options (mainly fossil fuels) and felt that nonrenewable options should be emphasized the least for predominantly economic reasons. This latter group expressed similar preferences as those outlined in the ECC and ERCB reports. Ensuring long term energy security was the most important reasons to over 40% of the respondents in all attitudinal categories regardless of their choice of most preferred energy option.

The variations in public environmental attitudes were found to be more strongly related to the respondents' societal values than to their socio-economic characteristics. Although the latter variables did account for some of the variation, their influence was relatively minor. The greatest divergence between the two extreme attitudinal groups centred around the issues of wealth creation and the limits to growth; technocentrists more strongly supported the former, ecocentrists the latter. These differences were also reflected in the varying emphasis given to energy policy objectives. Technocentrists emphasized the economic aspects of energy development while ecocentrists emphasized the environmental aspects. Long term energy security and ensuring that energy is available to all members of society were highly rated by a substantial proportion of respondents regardless of their attitudinal affiliation. Finally, while it was found that the vast majority of respondents adopted at least one energy conservation practice, ecocentrists tended to adopt more practices than

technocentrists, particularly if those practices involved ongoing behavioural adjustments.

The energy "debate" which emerged in the late 1970s is still evident in Canada and Alberta. Organizations wishing to advance "soft energy paths" are applying more sophisticated methodologies to energy projections than those undertaken ten years ago. Similarly, forecasting methods have also been improved upon and are generally less reliant on the extrapolation of past trends as means of projecting the likely occurrence of future events. However, there are differences between the studies using the different groups that can not be explained by the methodologies alone. It was argued in this thesis that the adherence to a particular world view has ramifications throughout the decision process that are ultimately reflected in the choice of an energy strategy or a particular energy option. These contrasts in world views, reasons for energy preferences, and the energy strategy itself are also manifested among the public. Significant portions of the public favour different energy alternatives for reasons that are generally consistent with those espoused by the particular forecasting agency. In other words, consensus as to the long term energy strategy Canada and Alberta should adopt is not evident among the public or the energy agencies examined in this thesis.

As was discussed earlier (Chapter 2), two major theoretical problems still confront the behavioural geographer; the problem of aggregation (i.e. the relationship of the individual to society) and the attitude-behaviour dichotomy. Steps toward their resolution have been advanced in this thesis.

Recent research in sociological theory has focussed on establishing linkages between macro-level theory and micro-level observations (Giddens, 1984; Knorr-Cetina and Cicourel, 1981). Cicourel (1981) maintains that social facts ("macro-facts") emerge from the routine practices of everyday life. As these "facts" become normalized, they become macro-structures. As Palm (1986, p. 471) states:

> It is the process of routinizing micro-level occurences through individual behavior that micro-events are transformed into organizational and interactive procedures, further structuring individual behavior. It follows from this line of argument that in order to integrate micro- and macro- social phenomena, it is necessary to identify the processes that contribute to the creation and evolution of macro- structures and to show that these processes are actually embedded in routine inferences.

Thus, the proponents of this perspective maintain that macro-level generalizations can and must be informed by micro-level investigations. In other words, "in order to make statements about higher-order systems like communities, cultures, and states, we have to make do with the raw material at hand: the individual human being and his or her microgeographic environment" (Blaut, 1984, p. 163).

The use of a common conceptual framework to analyze both forecasts (macro-level) and a sample of the public (micro-level) has allowed comparisons to be made between the two "levels" in a consistent manner. The sequence of world views to rationale (reasons and objectives) to preferences has been established as being both logically and statistically valid among the public. Given that the same components were isolated in the energy scenarios, it can be deduced that the same sequence is applicable to the energy scenarios as well. In other words, the methods used to project energy futures (i.e. forecasting or backcasting) are, implicity or explicity, subjective and conditional, and the results derived from the use of either method reflect the consequences or implications of core assumptions which in turn reflect a particular view of society. The sequence of decision-making by the public and by the forecasting agencies has been examined in what may be termed a "parallel" manner. In other words, the same components of decision-making were isolated and the decision sequence for each were found to be logically consistent. This result furthers the understanding of the similarities between macro and micro "facts" and, in this context, represents a step towards the empirical measurement of two "levels" of social phenomena. The next step is to establish empirically how attitudes and values are formed and communicated between the two levels, and the reciprocal relationship between policy and public perspectives of the energy issue.

The measurement of attitudes in terms of paradigms in part overcomes the limitations of assuming a simple one-to-one relationship between behaviours and antecedent variables. Although this represents a step towards uncovering the correspondence between attitudes and behaviours, it does not provide a complete solution even though some statistically significant relationships have been found and were in the expected direction (i.e. ecocentrists adopted more conservation practices than did technocentrists). Anomalies have been found which

could not be explained by the questionnaire data. The most notable was the large proportion of respondents who cited solar energy as their most preferred energy option and who held attitudes sympathetic to the ecocentric mode, but who did not have a solar device on their home. In fact, only 1% of the sample indicated that they had purchased a solar collector. The lack of adoption could not be explained on the basis of attitudinal data. Thus, the major problem associated with uncovering the relationship between attitudes and behaviours is the assumption of a direct link between the two. Variables mediating between attitudes and behaviours therefore need to be identified and incorporated into the research design in a manner similar to the reasons for choice variables which were found to be intervening between attitudes and preferences. Fishbein (Ajzen and Fishbein, 1980), in his theory of reasoned action, maintains that behavioural intention is the intervening variable and studies using his model have reported some success (e.g. Brown and Macey, 1983). Desbarats (1983) has modified Fishbein's model in order to incorporate measures of constraints (internal and external) as mediators between attitudes and behaviours. These attempts represent elaborations of the assumption of a simple causal link between attitudes and behaviours, a process that must continue if a solution is to be found. This study has contributed to that solution by verifying the ability of the attitude scale to measure environmental world views consistently. In future research, constraints affecting individuals' conservation behaviour should be incorporated and tested to see if they are in fact intervening variables.

The consideration of environmental attitudes in terms of paradigms, the confirmation of the attitude scale's reliability, and the verification of the reasons for choice as intervening variables has broadened the understanding of why different energy options are preferred by different groups within urban Alberta. While the theoretical merits have been alluded to, the results are not without practical value. Perhaps the most useful application will be in relation to specific problems and disputes, and as a means for clarifying positions and eliminating misunderstandings. Major areas of disagreement and congruence have been identified in both the energy forecasts and and the public as well as between subgroups of the public. Concern over long term energy security is shared by all regardless of affiliation, world view, or energy

preferences. Ensuring that energy is available to all members of society was also a common concern. The major area of disagreement centred around economics and the environment. It is around these issues that potential conflicts are most likely to arise.

9.3 Suggestions for Future Research

The study of society can be undertaken from two perspectives; one is concerned with social processes at a general level (e.g. structuralism, Marxism), while the second focuses on the individual actor (e.g. humanism, behaviouralism). Recent theoretical debates in geography and the other social sciences have centred on understanding and empirically verifying the dynamic interrelationship between the individual and the larger social structure. The theory of structuration advanced by Giddens (1984) posits that social structures are both constituted by human agency (i.e. individuals) and at the same time are the "medium" of this constitution. Central to this view of individual action are the concepts of ideology and values which play a broad mediating role between various actors and the social systems of which they are both products and producers (Duncan, 1985). In the past, geographers have generally overstressed the power of structures, as in structural marxism, or have granted near autonomy to the individual, as in neoclassical economics and behavioural geography, and have thus failed to capture the complexity of social action.

Although Giddens's theory of structuration is currently receiving a great deal of attention by geographers, there has been to date a relative dearth of studies attempting to verify the theory empirically (see Gregson, 1986). In this regard, geographic investigations of environmental attitudes and values have much to offer, not only because of the central role these variables have in the theory, but also because of the increased sophistication and conceptualization achieved by geographers working in this research area. Explicit attempts to formulate behavioural geographic research within the context of a broadly based social theory such as structuration are clearly warranted and should be pursued.

More research is also needed in uncovering more percisely the relationships between environmental attitudes and behaviours. In many ways, solutions to this problem are similar

to those required for the aggregation problem discussed above. Recent attempts to broaden the hypothesized causal links between attitudes and behaviours through the incorporation of intervening variables represent substantial improvements over earlier studies that assumed a simple one-to-one causal sequence between perceptions, attitudes, and specific behaviours. Of particular note are the attempts to incorporate constraints (both endogenous and exogenous to the individual) into behavioural models (e.g. Desbarats, 1983). Fundamental to models of this type is the relaxation of the assumption of complete volitional control by individual decision-makers and the incorporation of societal factors (constraints) in order to understand more completely human behaviour in the environment. Empirical investigations verifying the ability of the model to accurately measure and explain "constrained behaviour" are necessary.

Replication of the attitude scale used in this study is clearly warranted. In this way, the evolution of public environmental attitudes in Alberta can be discerned. The identical scale has been administered in Edmonton and Calgary in 1984 and 1986 and a reliable data base is emerging. The similarity of factor structures of the scale, which were administered at different intervals and on different samples, and during very different circumstances regarding the energy industry and energy prices, attests to the scale's validity and reliability.

The administration of the attitude scale on populations in other regions and provinces would also be fruitful. In this way, comparative analysis can be undertaken to determine areas of similarities and differences, as well as assisting in uncovering the processes involved in the formation and dissemination of attitudes towards the environment and its resources.

The emphasis on attitudes and preferences represents one of many ways of examining the complex and wideranging issues surrounding energy development and use in contemporary society. It is based on the increasingly recognized premise that these issues involve more than strictly economic and technical considerations. Problems and conflicts over energy issues demand the contribution from many academic disciplines, industries, governments, and a host of others if the goal of long term energy security for all is to be realized.

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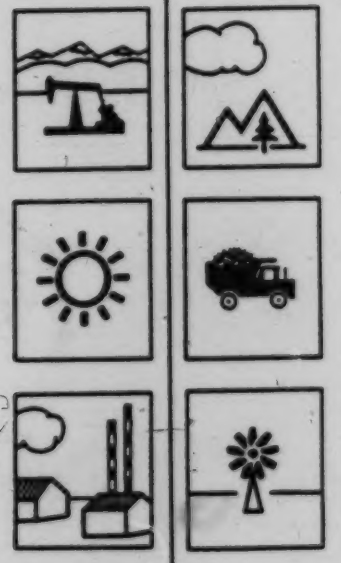
Appendix A

The Energy and the Environment Questionnaire

Energy and the Environment

A SURVEY OF ALBERTANS' OPINIONS



ENERGY AND THE ENVIRONMENT PROJECT
c/o DEPARTMENT OF GEOGRAPHY
UNIVERSITY OF ALBERTA
EDMONTON, ALBERTA T6G-2H4

THE QUESTIONNAIRE IS DIVIDED INTO SEVERAL SECTIONS. THE FIRST FEW QUESTIONS ARE CONCERNED WITH YOUR OPINIONS ABOUT ENERGY POLICY AND DEVELOPMENT.

Q-1 Do you expect the supply of conventional oil resources to be a problem for the *world as a whole* in the next twenty-five years? (Circle *one* number).

1 MAJOR SUPPLY PROBLEM

2 MINOR SUPPLY PROBLEM

3 NO PROBLEM AT ALL

Q-2 Which of the following do you think has the *greatest influence* in determining how Canadian energy resources get developed and used? (Circle *one* number).

1 THE FEDERAL GOVERNMENT

2 THE PROVINCIAL GOVERNMENTS

3 ENERGY COMPANIES

4 PUBLIC UTILITIES

5 THE GENERAL PUBLIC

6 OTHER (Please specify)_____

Q-3 How much influence do you think members of the general public have in affecting decisions about the development of Canadian energy resources? (Circle *one* number).

1 A MAJOR INFLUENCE

2 A MINOR INFLUENCE

3 NO INFLUENCE AT ALL

Q-4 Do you think that the federal and provincial governments should make a greater effort to promote energy conservation? (Circle *one* number).

1 YES

2 NO

Q-5 What, if anything, would you say is the *most important* good thing that happens when energy is saved? (Circle *one* number).

1 MORE ENERGY WILL BE AVAILABLE FOR THE FUTURE

2 ENERGY PRICES WILL COME DOWN

3 IMPORTS OF FOREIGN OIL WILL BE REDUCED

4 THERE WILL BE LESS POLLUTION AND ENVIRONMENTAL DAMAGE

5 OTHER (Please specify)_____

Q-6 A variety of goals and interests must be considered during the preparation of a strategy for energy development and use. How would you rate the importance of *each* of the following objectives for Canada? (Circle the appropriate number for *each* objective).

	Not at all Important	Not Too Important	Somewhat Important	Very Important
(1) To keep the cost of energy to the consumer as low as possible	1	2	3	4
(2) To ensure that energy is available to meet the essential needs of all members of society	1	2	3	4
(3) To ensure that energy is available for national economic security	1	2	3	4
(4) To minimize potential pollution and environmental impacts when domestic energy resources are being developed and used	1	2	3	4
(5) To encourage energy efficient practices in all sectors of society (e.g. industry, government, individual consumers)	1	2	3	4
(6) To create and maintain the maximum number of jobs	1	2	3	4
(7) To provide sustainable supplies of energy over the long term (i.e. beyond the year 2000)	1	2	3	4

Q-7 Which of the objectives listed in Question 6 do you consider to be the most important and second most important? (Put number of item in appropriate box).

[ ] MOST IMPORTANT OBJECTIVE

[ ] SECOND MOST IMPORTANT OBJECTIVE

NOW HERE ARE SOME QUESTIONS ABOUT VARIOUS TYPES OF ENERGY.

Q-8 A number of energy options are available to Canada. For *each* of the following options, please indicate how you would rate its potential to make a major contribution to advancing Canada's energy situation. (Circle the appropriate number for *each* option).

	Poor	Fair	Good	Very Good	Excellent
(1) Increase the use of coal for electricity generation	1	2	3	4	5
(2) Continue to develop conventional oil sources	1	2	3	4	5
(3) Increase the development of off-shore oil sources (e.g. Beaufort Sea)	1	2	3	4	5
(4) Develop and use wind energy	1	2	3	4	5
(5) Develop and use solar energy	1	2	3	4	5
(6) Develop and use nuclear power plants	1	2	3	4	5
(7) Increase the development of tarsands for oil	1	2	3	4	5
(8) Increase hydro-electric power generation	1	2	3	4	5
(9) Continue to develop natural gas resources	1	2	3	4	5
(10) Encourage energy efficient practices amongst individual members of the public	1	2	3	4	5
(11) Encourage energy efficient practices amongst industrial users	1	2	3	4	5
(12) Increase the use of wood for home heating	1	2	3	4	5
(13) Increase the use of wood for conversion to a gasoline additive (e.g. methanol)	1	2	3	4	5
(14) Require tougher energy efficiency standards for all buildings	1	2	3	4	5
(15) Require tougher energy efficient standards for all consumer products	1	2	3	4	5
(16) Other (Please specify) _____	1	2	3	4	5

THE NEXT FEW QUESTIONS ASK FOR YOUR OPINIONS ABOUT THE SHORT-TERM (THE NEXT FIVE YEARS) DEVELOPMENT OF CANADIAN ENERGY RESOURCES.

Q-9 In the *short run* (say the next five years), which of the items listed in Question 8 do you think Canada should *emphasize the most*? (Put number of item in the appropriate box).

☐ BEST IN THE SHORT RUN

☐ SECOND BEST IN THE SHORT RUN

Q-10 With respect to the option you *most prefer in the short run*, how important do you consider each of the following reasons are for your choice? (Circle the appropriate number for *each* reason).

	Not Important	Not Too Important	Somewhat Important	Very Important
(1) There are no other alternatives	1	2	3	4
(2) It has the advantage of creating more jobs.....	1	2	3	4
(3) It is the most economically efficient option.....	1	2	3	4
(4) Its environmental effects are less than those of the other options.....	1	2	3	4
(5) It will stimulate more growth in the economy.....	1	2	3	4
(6) Too much energy is now being wasted	1	2	3	4
(7) It will diversify Canada's energy resource base	1	2	3	4
(8) It will provide the energy we need for the longest time.....	1	2	3	4
(9) Other (Please specify)_____	1	2	3	4

Q-11 Which of the reasons listed in Question 10 do you consider to be the most important? (Put number of item in box).

☐ MOST IMPORTANT REASON

Q-12 In the *short run* (the next five years), which of the options listed in Question 8 do you think Canada should *emphasize the least*? (Put number of item in the appropriate box).

☐ WORST IN THE SHORT RUN

☐ SECOND WORST IN THE SHORT RUN

QUESTIONS 13 THROUGH 18 ASK FOR YOUR OPINIONS ABOUT THE LONG-TERM (BEYOND THE YEAR 2000) DEVELOPMENT OF CANADIAN ENERGY RESOURCES.

Q-13 In the *long run* (beyond the year 2000), which of the items listed in **Question 8** do you think Canada should *depend on most?* (Put number of item in the appropriate box).

[ ] BEST IN THE LONG RUN

[ ] SECOND BEST IN THE LONG RUN

Q-14 With respect to the option you *most prefer in the long run*, how important do you consider each of the following reasons are for your choice? (Circle the appropriate number for *each* reason).

	Not Important	Not Too Important	Somewhat Important	Very Important
(1) There are no other alternatives	1	2	3	4
(2) It has the advantage of creating more jobs	1	2	3	4
(3) It is the most economically efficient option	1	2	3	4
(4) Its environmental effects are less than those of the other options	1	2	3	4
(5) It will stimulate more growth in the economy	1	2	3	4
(6) Too much energy is now being wasted	1	2	3	4
(7) It will diversify Canada's energy resource base	1	2	3	4
(8) It will provide the energy we need for the longest time	1	2	3	4
(9) It will lead to a more agreeable society	1	2	3	4
(10) Other (Please specify) _____	1	2	3	4

Q-15 Which of the reasons listed in **Question 14** do you consider to be the most important? (Put number of item in box).

[ ] MOST IMPORTANT REASON

Q-16 In the *long run* (beyond the year 2000), which of the options listed in **Question 8** do you think Canada should *emphasize the least*? (Put number of item in appropriate box).

[ ] WORST IN THE LONG RUN

[ ] SECOND WORST IN THE LONG RUN

Q-17 With respect to the option you *least prefer in the long run*, how important are each of the following reasons for your choice? (Circle the appropriate number for *each* reason).

	Not Important	Not Too Important	Somewhat Important	Very Important
(1) It is unrealistic in economic terms	1	2	3	4
(2) Too many jobs would be lost	1	2	3	4
(3) The effects on the environment would be more serious than those of the other options.....	1	2	3	4
(4) It would not provide much security against potential shortages of energy.....	1	2	3	4
(5) It will lead to a less agreeable society	1	2	3	4
(6) Other (Please specify) _____	1	2	3	4

Q-18 Which of the reasons listed in Question 17 do you consider to be the *most important*? (Put number of item in box).

☐ MOST IMPORTANT REASON

Q-19 Have you made any effort to reduce the amount of energy that you use? (Circle *one* number).

1 NO (Skip to Question 21 on the next page)

2 YES

Q-20 Please list what you have done to conserve energy or to promote energy conservation. These may include things you have done in your household, your place of work, your transportation practices, or your personal habits.

A _____

B _____

C _____

D _____

E _____

F _____

G _____

QUESTIONS 21 AND 22 DEAL WITH YOUR CONCERN ABOUT THE ENVIRONMENT IN ALBERTA.

Q-21 How concerned are you about maintaining or improving the quality of the environment in Alberta? (Circle *one* number).

1 VERY CONCERNED

2 MODERATELY CONCERNED

3 NOT VERY CONCERNED

4 NOT AT ALL CONCERNED

Q-22 How do you feel about the enforcement of environmental regulations by the Government of Alberta? (Circle *one* number).

1 TOO TOUGH

2 ABOUT RIGHT

3 NOT TOUGH ENOUGH

4 NO OPINION

THE NEXT SECTION DEALS WITH A NUMBER OF ISSUES RELATED TO THE ENVIRONMENT.

Q-23 Here are some statements dealing with issues related to resources, economic activity, the quality of life, and the environment. Please read each statement carefully, then circle the number that corresponds *most closely* to your opinion about the statement. There are no right or wrong answers: it is *your* opinion which is important.

This is what the numbers mean:

1 indicates you *strongly disagree* with the statement
2 indicates you *disagree*, but *not* strongly
3 indicates you are neutral or indifferent
4 indicates you *agree*, but *not* strongly
5 indicates you *strongly agree* with the statement

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
In the long run, there are no limits to the extent to which we can raise our standard of living	1	2	3	4	5
The earth is like a spaceship with only limited room and resources	1	2	3	4	5
There are limits to growth beyond which our industrialized society cannot expand	1	2	3	4	5
We can continue to raise our standard of living through the application of science and technology.	1	2	3	4	5

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Humans must live in harmony with nature in order to survive	1	2	3	4	5
Economic growth improves the quality of life for all Canadians	1	2	3	4	5
The balance of nature is very delicate and easily upset	1	2	3	4	5
Rapid economic growth often creates more problems than benefits	1	2	3	4	5
Mankind is severely abusing the environment	1	2	3	4	5
We are approaching the limit to the number of people the earth can support	1	2	3	4	5
Most problems can be solved by applying more and better technology	1	2	3	4	5
Humans need not adapt to the environment because they can remake it to suit their needs	1	2	3	4	5
Mankind was created to rule over the rest of nature	1	2	3	4	5
We cannot keep counting on science and technology to solve mankind's problems	1	2	3	4	5
More emphasis should be placed on teaching children about nature than on teaching them about science and technology	1	2	3	4	5
When humans interfere with nature it often produces disastrous consequences	1	2	3	4	5
Science and technology often do as much harm as good	1	2	3	4	5
Canadians are going to have to reduce their consumption of material goods over the next few years	1	2	3	4	5
Humans have the right to modify the environment to suit their needs	1	2	3	4	5
The positive benefits of economic growth far outweigh any consequences	1	2	3	4	5
In general, the Canadian people would be better off if the nation's economy stopped growing	1	2	3	4	5

THE NEXT SECTION IS CONCERNED WITH YOUR OPINIONS ABOUT THE FUTURE OF ALBERTA GENERALLY.

Q-22 Modern society is based, in part, on many different ideas and opinions which you may or may not agree with. How would you describe the *ideal* type of society, from your point of view?

For example, if you think the ideal society is one in which there is more emphasis on competition, then circle a number towards the left-hand end of the scale, thus:

	A						B
A society in which there is (A) more emphasis on competition or (B) one in which there is more emphasis on cooperation?	1	(2)	3	4	5	6	7

	A						B
A society in which there is (A) a continually growing economy, or (B) one in which there is no growth?	1	2	3	4	5	6	7
A society in which (A) production is selective (e.g. towards products which use little energy), or one which (B) aims to satisfy the market for consumer goods?	1	2	3	4	5	6	7
An economy geared to (A) overcoming the limits to growth (e.g. from exhaustion of some raw materials), or one which (B) accepts that there are limits to growth?	1	2	3	4	5	6	7
A society in which (A) individuals live their lives within a community, or one in which (B) individuals are free to go their own way?	1	2	3	4	5	6	7
A society with (A) strong law and order, or one which (B) attaches relatively less importance to law and order?	1	2	3	4	5	6	7
A society in which (A) individuals have considerable say in how things get decided at their work-place, or one in which (B) decisions (after consultation) are left to management?	1	2	3	4	5	6	7
A society which (A) emphasizes work which is humanly satisfying, or one where (B) work is controlled mainly by the needs of industry?	1	2	3	4	5	6	7
A society which (A) emphasizes rewards for talent and achievement, or one where (B) the emphasis is on other criteria (such as need)?	1	2	3	4	5	6	7
A society which (A) emphasizes the social and collective provision of welfare, or one where (B) individuals are encouraged to look after themselves?	1	2	3	4	5	6	7
A society which (A) has a strong emphasis on community and belonging, or (B) one where the emphasis is on individualism?	1	2	3	4	5	6	7
A society which (A) emphasizes the participation of individuals in major government decisions, or (B) leaves the final decisions to the judgment of the elected officials?	1	2	3	4	5	6	7
A society which (A) recognizes differentials related to skill, education, and achievement, or one which (B) emphasizes similar incomes and rewards for everybody?	1	2	3	4	5	6	7

FINALLY, WE WOULD LIKE A FEW FACTS ABOUT YOURSELF. THESE QUESTIONS WILL BE USED FOR CLASSIFICATION PURPOSES ONLY. LIKE THE REST OF THE QUESTIONNAIRE, YOUR ANSWERS WILL BE KEPT COMPLETELY CONFIDENTIAL.

Q-25 Are you male or female? (Circle number).

1 MALE

2 FEMALE

Q-26 To which of the following age groups do you belong? (Circle number).

1 UP TO 25

2 26 TO 35

3 36 TO 45

4 46 TO 55

5 56 TO 65

6 OVER 65

Q-27 What is the highest level of formal education that you have achieved? (Circle number).

1 ELEMENTARY (UP TO GRADE 6)

2 SECONDARY (UP TO GRADE 12 OR 13)

3 POST-SECONDARY/TECHNICAL

4 SOME UNIVERSITY

5 UNIVERSITY GRADUATE

6 POST-GRADUATE

Q-28 What was (or is) your major? (Please write in the main subject you studied at University).

_____

Q-29 In which of the following categories does the *total annual income* of your entire household fall? (Circle number).

1 LESS THAN $15,000

2 $15,000 to $30,000

3 $30,000 to $45,000

4 $45,000 to $60,000

5 $60,000 AND OVER

Is there anything else you would like to express about the topics dealt with in this questionnaire? If so, please use this space for that purpose.

Thank you. We look forward to receiving your answers. Your contribution to this project is very much appreciated.

Appendix B

Covering Letters and Reminder Card

Energy and the Environment

c/o DEPARTMENT OF GEOGRAPHY, UNIVERSITY OF ALBERTA, EDMONTON, ALBERTA T6G-2H4

September 15, 1986

Dear Sir or Madam:

There has been much uncertainty with energy in Alberta over the past 15 years. Price increases and potential shortages were the major concerns in the 1970s. Now, reduced prices and revenues may threaten the prosperity of the Province. The future prospects are still very much in doubt. Energy affects nearly everyone. Therefore, it is crucial to know what the Alberta public thinks about the development and use of energy if policy-makers are to make the right choices in the interests of all Albertans.

You are one of a small number of people chosen to give your opinions on these matters. Your name was selected from a random sample of the entire province. I respectfully ask your help (or any other adult member of your household) in completing the enclosed questionnaire and returning it as soon as possible. Your answers and ideas are *important!*

You may be assured of complete confidentiality. Once the questionnaire is returned, there will be *no way of identifying who has filled it out.* A business reply envelope is included in the package, so a stamp is not required.

This is an independent research project. While the overall results will be presented to Alberta energy policy-makers, no personal information will be released.

The success of this survey depends on your cooperation. Please take the time to complete the questionnaire and return it in the enclosed envelope. I will be happy to answer any questions you may have. Please write or call. My telephone number is 432-5623.

Thank you for your assistance.

Sincerely,

Richard G. Kuhn
Project Director

RGK/sf

ENERGY AND THE ENVIRONMENT PROJECT
DEPARTMENT OF GEOGRAPHY, UNIVERSITY OF ALBERTA
EDMONTON, ALBERTA T6G 2H4

Dear Sir or Madam,

About a week ago a questionnaire seeking your opinions about energy and environmental issues was mailed to you. Your name was drawn from a random sample of households in Alberta.

This card is being sent to everyone who received the questionnaire. As was pointed out in the original letter, the survey is completely anonymous and so there is no way of telling if your questionnaire is one of those already returned. If you have filled out and returned the questionnaire we'd like to thank you for your cooperation.

The success of the survey depends on the help of all who received the questionnaire. If you have not already completed it and mailed it back, we would be most grateful if you would do so.

Once again, thank you for your participation in the survey.

Sincerely,

Richard G. Kuhn
Project Director

ENERGY AND THE ENVIRONMENT PROJECT
c/o DEPARTMENT OF GEOGRAPHY
UNVIVERSITY OF ALBERTA
EDMONTON, ALBERTA
T6G 2H4

October, 1986

Dear Sir or Madam,

During the month of September, you were mailed a questionnaire designed to find out Albertans' opinions about energy and the environment. You are one of a small number of people chosen to give your opinions on these matters. Your name was selected from a random sample of the entire province.

It is important that all questionnaires are completed in order that a fair representation of all Albertans can be obtained. To date, however, the response rate has not been high enough to allow strong conclusions to be made. Since we had no way of determining who has already completed the questionnaire, all respondents were phoned. You indicated to us that you were unable to complete the survey but would take the time to do so if another questionnaire was sent. We are therefore enclosing another copy along with a business-reply envelope.

The success of this survey depends on the help of everyone who has received the questionnaire. We hope that you will agree with us that energy and the environment are, and will continue to be, important issues in Alberta. It is important to know what the Alberta public thinks about these issues if policy-makers are to make the right choices in the interests of all Albertans.

This is an independent research project. The overall results, however, will be presented to Alberta energy policy-makers in the near future.

Once again, thank you for your assistance.

Richard G. Kuhn

Project Director